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Facial Affect Reciprocity in Dyadic Interactions

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14. ABSTRACT *(Maximum 200 words)*: The purpose of this effort was to examine a new theoretical framework called Facial Affect Reciprocity, which refers to the exchange of facial expressions among interactants across time, and the linkage between specific types of emotion. We examined whether different combinations of facial expressions of emotion of pairs of individuals engaged in an interactive game requiring cooperation and adaptation would be reliably related to objective performance data. Same-sex stranger dyads participated in three conditions of game play in three studies. The game used was a modified version of Prisoner's Dilemma, which was played in real time, in person, and with real money to maximize the interaction's effects on emotions and expressions. Facial affect reciprocity variables predicted the behavioral outcomes of the dyads above and beyond what could be predicted by the individual facial expression variables, as predicted. Surprisingly, however, the exchange of no emotions or neutrality that was the best predictor of performance. These findings suggest a strong potential role for expression regulation in dyadic interchange and have important ramifications to theoretical and conceptual knowledge concerning the interpersonal functions of facial expressions of emotion. They also have important practical implications for emotion and expression regulation in team processes.

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Facial Affect Reciprocity in Dyadic Interactions

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EXECUTIVE SUMMARY

Research Requirement:

Effective team performance is vital for all branches of the military at all levels. Although a considerable amount of research has uncovered important findings concerning team performance and individual effectiveness in teams, to date there is very little empirical data on exactly how, what, and why team performance changes as a function of the appearance and flow of emotional responding of group members. Such questions are rooted in a basic understanding of the interpersonal functions of emotion and expression; yet, research on the interpersonal functions of facial expressions of emotion is still in its infancy. The purpose of this effort was to examine a new theoretical framework concerning the interpersonal functions of facial expressions of emotion called Facial Affect Reciprocity, which refers to the *exchange* of facial expressions among interactants across time, and the *linkage* between specific types of emotion. More specifically, the efforts examine whether different combinations of facial expressions of emotion of pairs of individuals engaged in an interactive game requiring cooperation and adaptation would be reliably related to objective performance data in three tasks.

Procedure:

Task 1 involved same sex stranger dyads including only participants born and raised in the United States (U.S.), who participated under standard conditions with ample time for decision and responses; this task was the Control Condition. Task 2 involved same sex stranger dyads, but all pairs were intercultural: One individual was a U.S.-born-and-raised American, while the other was a foreign-born international student. All other conditions were the same as Task 1; this task was the Intercultural Condition. Task 3 involved same sex stranger dyads including only U.S.-born-and-raised Americans, but they participated in very quick rounds and were instructed to be selfish; we considered this task the Stress Condition. The game used in all investigations was a modified version of Prisoner's Dilemma; this game was chosen because it is one of the most well-known and commonly used games in the cooperation and trust literature. The game was played in real time, in person, and with real money to maximize the interactions' effects on emotions and expressions.

Findings:

The Facial Affect Reciprocity variables predicted the behavioral outcomes of the dyads above and beyond what could be predicted by the individual facial expression variables, as predicted. Surprisingly, however, it was not the exchange of *emotional expressions* per se that was the best predictor of the various outcomes; instead it was the exchange of *no emotions* or neutrality that was the best predictor. Reciprocal neutrality was associated with greater cooperation, less competitiveness, and better outcomes (in terms of dollar payoffs) in all three studies. This finding is especially interesting given the fact that the participants were clearly emotional (as evidenced by their self-reported emotional experiences), and showed a variety of

emotional expressions, both positive and negative, throughout the game play. These findings suggest a strong potential role for *expression regulation* in dyadic interchange. Post-hoc analyses also showed that cooperative play generated more synchrony in self-reported emotional experiences between the interactants and that the Intercultural Condition (Task 2) produced far less cooperation and greater competition than the Control Condition (Task 1), at levels comparable to the Stress Condition (Task 3). Dyadic performance in the Intercultural Condition was reliably associated with differences between the interactants' home country scores on Hofstede's (2001) dimension of Power Distance.

Utilization and Dissemination of Findings:

The main findings suggest a role for the concept of emotion regulation in predicting better behavioral outcomes in dyadic interaction. Emotion regulation refers to the degree to which individuals can manage and modify their emotional reactions in order to achieve constructive, goal-directed outcomes. One component of emotion regulation is expression regulation—the management and modification of emotional expressions. Expressing neutrality despite the fact that one is obviously emotional might reflect attempts by both players to not allow their emotional reactions to get the better of them as they made decisions concerning game play, thus allowing for more cooperative plays and better outcomes. Also, the mutual reciprocation of neutrality probably served to demonstrate to the other player that one's emotions were not getting the better of oneself, thus allowing for more rational decision making that led to cooperative play. These findings have important ramifications to theoretical and conceptual knowledge concerning the interpersonal functions of facial expressions of emotion. They also have important practical implications for emotion and expression regulation in team processes.

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FACIAL AFFECT RECIPROCITY IN DYADIC INTERACTIONS

Effective team performance is vital for all branches of the military at all levels. Although a considerable amount of research has uncovered important findings concerning variables influencing team performance and individual effectiveness in teams (Fleishman & Quaintance, 1984; Fleishman & Zacarro, 1992), in recent years there is an increased interest in how human emotions calibrate the behaviors of individuals interacting cooperatively during task performance or decision making. Despite this growing awareness, however, there is very little empirical data on exactly how, what, and why team performance changes as a function of the appearance and flow of emotional responding of group members. Such questions are rooted in a basic understanding of the interpersonal functions of emotion. Yet, research on the interpersonal functions of facial expressions of emotion is still in its infancy.

The purpose of the effort reported here is to contribute to this literature, with a specific focus on the social meaning of facial expressions of emotion and the role facial expressions play in group performance tasks. I propose a new theoretical framework positing a central role for a concept known as Facial Affect Reciprocity (FAR) as an important mediating mechanism in explaining group performance and function. Below I introduce this new theoretical paradigm and describe three investigations that examine it, that specifically test hypotheses generated from it using dyadic pairs playing an interactive game requiring cooperation and adaptation, and that generate objective performance data. The findings contribute to basic knowledge about emotions and are based in a paradigm that is relevant for the U.S. military.

This section begins with a definition of emotion and a discussion of facial expressions as a component of emotion. I discuss what is known in the literature about the intra- and interpersonal functions of facial expressions of emotion, and then describe the new theoretical framework highlighting the concept of FAR. I describe the types of FAR and their implications to group functioning and performance, which provides the derivation of specific hypotheses to be tested in the studies proposed. I then describe the three investigations designed to test these ideas initially.

A Model of Emotion

Humans experience a wide range of affective phenomena. Being tired, bored, sleepy, excited, and hungry are states associated with affect, as are anger, fear, sadness, love, shame, pride, embarrassment, and jealousy. Although laypersons (and sometimes researchers) use the terms affect, feeling, and emotion interchangeably, emotions are a special type of affective phenomenon. Affect is a subjective experience, a feeling, and humans experience affect on a rather continuous basis. Contrastingly, emotions are *transient, bio-psycho-social reactions designed to aid individuals in adapting to and coping with events that have immediate implications for their well-being.* Emotions are biological because they involve the brain, the muscles, the autonomic system, and other aspects of human physiology. Emotions are psychological because they involve specific mental processes required for elicitation and regulation of response. And emotions are social because they are often elicited by social factors and have social meaning.

Emotions are different than moods, personality traits and dispositional affect, and sentiments (Ekman, 2003; Kelly & Barsade, 2001). While emotions are transient, rapid reactions to ongoing events, moods, dispositional affect, and sentiments are different components of affective experience. Moods tend to be more enduring and less intense.

Within the category of emotion, humans experience a wide range of different types of emotion, and there are many words that denote them. Shaver and colleagues (Shaver, Schwartz, Kirson, & O'Connor, 1987), for instance, identified 135 words in American English that participants called emotions. Similarly large numbers of emotion terms have been found in other languages as well (Matsuyama, Hama, Kawamura, & Mine, 1978; Romney, Moore, & Rusch, 1997; Shaver, Murdaya, & Fraley, 2001; Shaver, Wu, & Schwartz, 1992). In my work, I focus on a small set of this wide range of emotions that appear to be universal (Ekman, 1992a, 1992b, 1999): These include anger, contempt, disgust, fear, enjoyment, sadness, and surprise.

These emotion labels are actually place-holders denoting a family of related emotions (Ekman, 1993, 2003). For example, the anger family contains emotions denoted by the terms annoyed, irritated, frustrated, pissed off, angry, mad, hostile, exasperated, furious, and enraged. The fear family includes anxious, nervous, tense, worried, apprehensive, frightened, terrified, horrified, and mortified. Specific emotion labels denote variations in intensity and/or the eliciting circumstances (Scheff, 2006; Shaver et al., 1987). Despite their differences, however, activation within a basic emotion "family" occurs as part of the same core emotion system.

Facial Expressions of Emotion

My approach to the study of facial expressions has its roots in the work of Darwin (1872), and those who have refined and elaborated his evolutionist claims (Ekman, 1992c; Izard, 1971; Matsumoto, Keltner, Shiota, Frank, & O'Sullivan, 2008). Darwin claimed, in his principle of serviceable habits, that facial expressions are the residual actions of more complete behavioral responses. Facial expressions are part of emotion-related actions; they occur in combination with other bodily responses (vocal, postural, gestural, skeletal muscle movements) and physiological responses. Thus, we express anger by furrowing the brow and tightening the lips with teeth displayed because these actions are part of an attack response, and we express disgust with an open mouth, nose wrinkle, and tongue protrusion as part of a vomiting response. Facial expressions, then, are elements of a coordinated response involving multiple response systems.

According to Darwin, all people, regardless of race or culture, possess the ability to express some emotions in exactly the same ways, primarily through their faces. Darwin wrote *The Expression of the Emotions in Man and Animals* to refute the claims of Sir Charles Bell, the leading facial anatomist of his time and a teacher of Darwin's, about how God designed humans with unique facial muscles to express uniquely human emotions. Relying on advances in photography and anatomy (Duchenne de Boulogne, 1862/1990), Darwin engaged in a detailed study of the muscle actions involved in emotion and concluded that the muscle actions are universal; their precursors can be seen in the expressive behaviors of nonhuman primates and other mammals. This analysis set the stage for the development of coding systems used in the identification of facial expressions that have been central to the empirical literatures reviewed here.

Evidence from adult humans across cultures. Claims concerning the universality of facial expressions of emotion are rooted in the notion that the facial anatomy is brought into service in expressions to solve similar problems across cultures related to social living, such as restoring justice, attending to others in need, signaling danger, expressing sexual or affiliative interest, and so on. By implication, the facial muscles themselves should be universal, and indeed they are. All humans around the world have the same facial anatomy (Gray & Goss, 1966). This universal facial musculature, furthermore, appears to be activated in emotion-specific ways across cultures.

The strongest evidence for the universality of facial expressions of emotion comes from facial production efforts that directly measure facial behaviors when emotions are elicited. The first was Ekman's (1972) classic study involving American and Japanese participants who viewed neutral and stressful films and whose facial behaviors, unbeknownst to them, were recorded throughout the experiment and coded using a modified version of Facial Affect Scoring Technique (FAST), a precursor to the Facial Action Coding System (FACS) (Ekman & Friesen, 1978). Two sets of analyses were performed on the facial codes: one involving separate facial areas and one involving the whole face. The rank order correlations on the facial behavior codes from the separate areas between the American and Japanese participants ranged from .72 for the eyes-lids area to .92 on the brows-forehead area. When the codes were combined into emotion-related configurations the correlations ranged from .86 in the brows-forehead region to .96 in the lower face. Disgust, sadness, anger, and surprise were the most frequently displayed emotions; but fear and happiness were also evident. When facial codes were combined for whole face emotions, according to the theoretical rationales of Darwin (1872) and Tomkins (1962, 1963), and the empirical findings from judgment investigations (reviewed below), the correlation between the Americans and the Japanese on the frequencies of whole face emotions expressed spontaneously was .88.

Since Ekman's study described above, at least 74 published investigations have appeared in which individuals participated in emotionally-arousing conditions where their facial behaviors were actually coded reliably with the FACS and matched to the universal facial configurations of emotion (Matsumoto, Keltner et al., 2008). These studies demonstrate that the facial configurations of at least seven emotions, as postulated by Darwin and Tomkins, are produced when emotion is aroused and there is no reason to modify the expression because of social circumstances. These do not include a published ethology of several different pre-industrial cultures (Eibl-Eibesfeldt, 1989), because the methods used were very different than those found in psychology.

The range of cultures in the 74 studies is impressive. Matsumoto and Willingham's (Matsumoto & Willingham, 2006) study, for instance, involved 84 athletes from 35 countries. Participants in other studies were American, Japanese, German, Canadian, and French. Collectively these studies demonstrate that the facial expressions reported originally by Ekman actually do occur when emotion is aroused in people of different cultures.

Evidence from the developmental literature. The same facial musculature that exists in adult humans exists in newborn infants and is fully functional at birth (Ekman & Oster, 1979). As such, infants have a rich and varied repertoire of facial expressions, including those that

signal not only emotional states, but also interest and attention (Oster, 2005). There is widespread consensus that smiling; distaste, the infant precursor of adult disgust; and crying, the universal signal of sadness/distress, occur in neonates (Oster, 2005). There is some controversy as to when other differentiated and discrete negative emotions occur. Some authors suggest that discrete negative emotions exist from birth, or shortly thereafter, and emerge according to a maturational timetable (Izard, 1991; Izard & Malatesta, 1987; Tronick, 1989). Others suggest that infants, at least within the first year of life, display relatively undifferentiated or modulated negative expressions, which ultimately transform into more differentiated, discrete expressions (Camras, Oster, Campos, & Bakeman, 2003; Oster, 2005). Discrete expressions of anger and sadness have been reported in the early part of the second year of life (Hyson & Izard, 1985; Shiller, Izard, & Hembree, 1986). By the third year, however, children display discrete, universal expressions of the other emotions as well (Casey, 1993).

Evidence from congenitally blind individuals. Another source of evidence for the universality of facial expressions of emotion comes from studies of blind individuals. Because these individuals cannot see the facial expressions of others, they could not learn to produce expressions by modeling. If blind individuals express facial emotions in the same way as sighted individuals, this would be compelling evidence for a biologically innate source of universal human expressions.

To date there have been 10 studies that examined the spontaneous expressive behavior of blind individuals, all reporting that blind individuals spontaneously produced the same types of emotional expressions as sighted individuals (Charlesworth, 1970; Cole, Jenkins, & Shott, 1989; Eibl-Eibesfeldt, 1973; Freedman, 1964; Galati, Miceli, & Sini, 2001; Galati, Sini, Schmidt, & Tinti, 2003; Goodenough, 1932; Ortega, Iglesias, Fernandez, & Corraliza, 1983; Peleg et al., 2006; Thompson, 1941). The most recent research in this area has shown that facial expressions are much more concordant among blind individuals' family members compared to non-kin (Peleg et al., 2006), and among monozygotic v. dizygotic twins (Kendler et al., 2008). A recent study from our laboratory also demonstrated considerable similarities in the facial expressions of emotion in born-blind and not-born-blind individuals from many different cultures (Matsumoto & Willingham, 2009). Cumulatively, these studies demonstrate that the universal facial expressions are not dependent on visual learning or modeling and strongly implicate a biologically innate source for their occurrence.

Evidence from non-human primates. A final line of evidence for universal facial expressions of emotion comes from studies of nonhuman primates. For years, ethnologists (Chevalier-Skolnikoff, 1973; Geen, 1992; Hauser, 1993; Snowdon, 2003; van Hooff, 1972) noted the morphological similarities between human expressions of emotion and nonhuman primate expressions displayed in similar contexts. Van Hooff (1972) described the evolution of the smile and laugh along two different evolutionary tracts across early mammals, monkeys, apes, chimpanzees, and humans. Redican (1982) suggested that among nonhuman primates, facial displays described as grimaces and open-mouth grimaces were akin to the human emotions of fear and surprise; that the tense-mouth display was similar to anger and that both combined formed the often identified threat display; and that non-human primates show a play face that is similar to the happy face of humans. Redican (1982) also suggested that the non-human pout served a similar function to the human sad face. Ueno, Ueno, and Tomonaga (2004)

demonstrated that both infant rhesus macaques and infant chimpanzees showed different facial expressions to sweet and bitter tastes, but that the chimps' facial expressions were more similar to human facial expressions than to that of the macaques. However, even some of the smaller apes, such as siamangs (*Symphalangus syndactylus*), noted for their limited facial expression repertoire, have distinguishable facial expressions accompanying sexuality, agonistic behavior, grooming, and play (Liebal, Pika, & Tomasello, 2004). For some states a species less closely related to humans than chimpanzees, the bonobos (*Pan paniscus*), may have more emotions in common with humans (De Waal, 2002).

The most recent research has gone beyond demonstrating equivalence in morphological descriptions of expressions to identifying the exact facial musculature used in producing the expressions being described. Vick et al. (2007) and Waller et al. (2006) report that the forehead musculature of chimps is less well developed than that of humans. (They speculate that the greater hairiness of chimps makes eyebrow movements less visible, hence less communicative.) But many other facial muscles and expressions have homologues and analogues comparable to those defined in the human FACS (Ekman & Friesen, 1978), including those precisely related to the human mimetic musculature associated with emotion signaling (Parr, Waller, & Fugate, 2005; Parr, Waller, Vick, & Bard, 2007; Waller et al., 2006). There is now a ChimpFACS that allows for identification of the specific Action Units (AUs) chimpanzees use in producing facial expressions. Recent research has demonstrated minimal differences in the underlying mimetic musculature for the AUs that are common between humans and chimps (Vick, Waller, Parr, Pasqualini, & Bard, 2007). Such comparisons reveal that chimps clearly have the facial musculature necessary to produce homologous expressions of anger, disgust, sadness, happiness, and fear, and that they do so, as we stated at the outset of this section, in similar contexts (e.g., threat, affiliation) as those that elicit human emotion.

The studies reviewed in this section are all production studies, in which spontaneously produced expressions have been examined in emotionally-evocative situations. When combined with the hundreds of studies demonstrating universality of judgments of facial expressions of emotion (Elfenbein & Ambady, 2002; Matsumoto, 2001), the converging wealth of evidence for the universality of facial expressions of emotion is considerable.

The Functions of Facial Expressions of Emotion

Intrapersonal functions. One important question about the nature of emotion concerns the degree to which the various response components—expressive behaviors (face, voice, posture), physiology (autonomic nervous system, central nervous system), cognitions (attention, higher mental processes), subjective experience, and motor behaviors—are related to each other in an organized, coordinated fashion. An evolutionist approach suggests that select facial expressions will co-vary with emotional experience and other components of emotional responding. Within the literature on signaling, a critical theoretical tension concerns the extent to which displays, such as the croak of the male frog seeking a mate, are deceptive, or are reliable signals of properties and conditions of the signaler (Ekman, 1989; Ekman & O'Sullivan, 1991; Fridlund, 1994; Hauser, 1993; Krebs & Dawkins, 1984). Facial expressions that accompany emotion are more reliable signals; they act as commitment devices to likely courses of action that are momentarily beyond the individual's volitional control (Frank, 1988; Gonzaga, Keltner, & Londahl, 2001). These issues have been studied over the years under various terms. Here I refer

to the idea that emotional responding, including facial expressions, is part of an organized and coordinated system known as *response coherence*. This view has emerged from a view of the intrapersonal functions of emotion that views the function of emotion as aiding individuals to prepare to adapt their behavior in response to changing environmental stimuli (Darwin, 1872; Levenson, 1999).

Empirical studies over the years have provided mixed results concerning whether response coherence exists. Some studies have reported only weak (Weinstein, Averill, Opton, & Lazarus, 1968) to moderate (Hubert & de Jong-Meyer, 1990) relationships between subjective experience and physiological responses, as well as between facial expressions and subjective experience or physiology (Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Ekman, Davidson, & Friesen, 1990). Others have reported no relationship among response components (Jakobs, Manstead, & Fischer, 2001; Mauss, Wilhelm, & Gross, 2004), and some even negative relationships (Buck, 1977; Lacey, 1967; Lang, 1988). Given this state of affairs, it is no wonder that meta-analyses of the literature often report that the evidence for emotion response system coherence is weak or non-existent (Cacioppo, Berntson, Larsen, Poehlman, & Ito, 2000; Murphy, Nimmo-Smith, & Lawrence, 2003; Phan, Wager, Taylor, & Liberzon, 2002).

One of the methodological issues that any study examining coherence must deal with concerns when to determine that an emotion is occurring. Most studies rely on self-report. Self-report, however, especially after an emotion has occurred, is confounded by a host of factors, including verbal ability, social construction, social desirability, memory, and others. This is especially problematic if one studies emotion within the operational definition proposed above (i.e., as a transient, short-lived reaction), and the greater the amount of time that elapses from the few seconds in which an emotion is aroused to the time of self-report, the greater the problems of reliability of the report-based data.

One way to address this limitation, however, is to utilize rapid, online, unobtrusive signals of emotion that may serve as markers that an emotion is occurring. Facial expressions offer such markers. If facial expressions are used as markers of emotion when it is actually occurring, and other response systems (e.g., physiology, subjective experience) are examined precisely at the same time, it may be that evidence for coherence may be stronger and clearer.

And this is precisely what has been found. Specifically, 22 of the 23 studies that have examined the relationship between facial expressions and self-report of experience have reported coherence (Matsumoto, Keltner, O'Sullivan, & Frank, 2007). These studies involved a variety of different types of emotion elicitors, researchers, and experimental designs. Perhaps the most salient aspect of these findings is that linkage between discrete facial expressions of emotion and self-reports of the same emotional states are stronger in within-subject designs that involve precise, second-to-second measurement of both expression and experience, such as Rosenberg and Ekman's (1994) study and that by Mauss and colleagues (2005). In the latter, cross-lag correlations indicated very high within-individual correlations between facial behavior and experience intensity for both amusing and sadness-eliciting films: .73 and .74, respectively. When correlations were corrected for disattenuation, the correlations were even higher: .89 and .97, respectively.

Similar findings have been demonstrated in studies examining the coherence of facial expressions and physiological responses. Seven studies have examined physiological responses when emotions are aroused and discrete facial expressions are used as markers of those emotions, and all seven have reported coherence between facial expressions and discrete physiological signatures. Mauss et al. (2005), for example, elicited emotions and measured expressive behavior, experience, and physiology in precise, moment-to-moment fashion in a within-subject design, and reported clear, moderately-sized, within-individual correlations between facial behavior and the various physiological response components. Lerner, Gonzalez, Dahl, Haririr, and Taylor (2005) demonstrated that the discrete facial expressions of fear, anger, and disgust were reliably linked not only to cardiovascular responses but to neuroendocrine activity as well.

Other studies have measured physiological reactions when emotions are elicited (Soto, Levenson, & Ebling, 2005; Tsai & Chentsova-Dutton, 2003; Tsai, Chentsova-Dutton, Freire-Bebeau, & Pryzmus, 2002; Tsai, Levenson, & Carstensen, 2000; Tsai, Pole, Levenson, & Munoz, 2003), and report cross-cultural and cross-ethnic similarities in the physiological signatures associated with emotion. Other studies that use the Directed Facial Action Task, in which participants are asked to innervate facial muscles corresponding to the discrete facial expressions of emotion, have also demonstrated the same physiological signatures (Ekman, Levenson, & Friesen, 1983; Levenson, Ekman, & Friesen, 1990; Levenson, Ekman, Heider, & Friesen, 1992). These patterns exist in people from cultures as widely divergent as the United States and the Minangkabau of West Sumatra, Indonesia. Directed facial action also activates specific brain regions (Lee, Josephs, Dolan, & Critchley, 2006). These findings highlight how emotions signaled by the face help prepare individuals for behaviors congruent with those emotions by initiating and perhaps maintaining appropriate whole-body activity (Levenson, 1999, 2003).

Another source of evidence supporting the link between the display of facial expressions and emotional response comes from studies that demonstrate a link between facial expressions of emotion and subsequent behaviors. Because emotion is an important basis of motivation (Tomkins, 1962, 1963), and because facial expressions are reliable signals of emotion, it comes as no surprise that facial expressions of emotion can signal behavioral intent. In the first study to demonstrate this effect, Ekman, Friesen, and Ellsworth (1972) demonstrated that the facial expressions of emotion produced by children as they watched television was related to their subsequent hurtful behaviors and aggressive play. Matsumoto, Haan, Gary, Theodorou & Cooke-Carney (1986) also showed that the facial expressions of emotion of preschool dyads as they engaged in a Prisoner's Dilemma game were reliably linked to the actions of the game, and that expressions that occurred after an action predicted the subsequent action. Keltner, Moffitt, and Stouthamer-Loeber (1995), in their study of adolescent boys, demonstrated that facial expressions of anger displayed in an interactive IQ testing context correlated significantly with teacher ratings of delinquent and aggressive behavior at school; facial displays of fear correlated negatively with these behaviors, and positively with withdrawal-related behaviors.

Another line of evidence comes from studies of the "facial feedback hypothesis." Although different versions of this hypothesis exist (Camras, Holland, & Patterson, 1993; McIntosh, 1996), numerous studies have demonstrated that facial expressions augment

contemporaneous subjective emotional experience (Hess, Kappas, McHugo, & Lanzetta, 1992; Lanzetta, Biernat, & Kleck, 1982; Larsen, Kasimatis, & Frey, 1992; McCanne & Anderson, 1987; Rutledge & Hupka, 1985; Soussignan, 2002; Zuckerman, Klorman, Larrance, & Spiegel, 1981). The effect occurs for both positive and negative emotions (Larsen et al., 1992), and influences not only subjective experience but also autonomic responses (Hess et al., 1992; Laird, 1974; Lanzetta et al., 1982; Vaughan & Lanzetta, 1981; Zuckerman et al., 1981). One of the most recent studies has shown that facial feedback effects are most powerful when the facial configurations correspond to the universal emotional expressions (Soussignan, 2002). Numerous reviews of this literature over the years have consistently reported such augmentation effects (Camras et al., 1993; Laird, 1984; Matsumoto, 1987; McIntosh, 1996; Winton, 1986), and in some cases suggest that facial expressions can initiate experience (Levenson et al., 1990; McIntosh, 1996).

Complementing these studies are others that provide converging evidence concerning the interrelationships among the various components of emotional responding, which are to be expected if the response components are coordinated and organized. For example, Duchenne smiles—smiles involving the innervation of both the muscle circling the eyes (orbicularis oculi) and the muscle that raises the lip corners (zygomatic major)—have been correlated with the experience of positive emotion in young and old adults (Frank, Ekman, & Friesen, 1993; Hess, Banse, & Kappas, 1995; Keltner & Bonanno, 1997; Smith, 1995). The facial signals related to embarrassment and amusement (e.g., gaze aversion and smile controls versus the open-mouthed smile) have been correlated with self-reports of these emotions (Keltner, 1995). Spontaneous laughter and smiling were found to have some distinct experiential correlates (Keltner & Bonanno, 1997), and the intensity of laughter or smiling correlated with self-reports of the funniness of the humorous stimuli (McGhee, 1977; Ruch, 1995). Across-cultures ratings of perceived expression intensity have been correlated with inferences about subjective experiences (Matsumoto, Kasri, & Kooken, 1999), and universality in phenomenological emotion response system coherence has been demonstrated in a study involving 3,000 participants in 27 countries (Matsumoto, Nezlek, & Koopmann, 2007).

Interpersonal functions. Facial expressions of emotion are more than simple readouts of internal states; they coordinate social interactions through their informative, evocative, and incentive functions (Keltner & Kring, 1998). That is, facial expressions of emotion have enormous signal value, and thus considerable interpersonal function. This literature is especially germane to this report.

Facial signals of emotion facilitate specific behaviors in perceivers. Because facial expressions of emotion are universal social signals, they contain meaning not only about the expresser's intent and subsequent behavior, but also about what the perceiver is likely to do. Marsh, Ambady, and Kleck (2005) showed observers fearful and angry faces and asked them to either push or pull a lever when they saw those expressions. These responses were associated with approach and avoidance behaviors: Anger facilitated avoidance-related behaviors, while fear facilitated approach-related behaviors. Winkielman, Berridge, and Wilbarger (2005) conducted two studies that demonstrated that subliminal presentation of smiles produced increases in how much beverage people poured and consumed and how much they were willing to pay for it; presentation of angry faces decreased these behaviors. Also, emotional displays

evoke specific, complementary emotional responses from observers—for example, anger has been found to evoke fear (Dimberg & Ohman, 1996; Esteves, Dimberg, & Ohman, 1994), whereas distress evoked sympathy and aid (Eisenberg et al., 1989).

Facial signals of emotion as signs of the nature of interpersonal relationships. Some of the more important and provocative sets of findings in this area come from Gottman and Levenson's (Gottman & Levenson, 1992; Gottman, Levenson, & Woodin, 2001) studies involving married couples. In their research, married couples visit their laboratory, after having not seen each other for 24 hours, and then engage in intimate conversations about daily events, issues of conflict, etc. Discrete expressions of contempt, especially by the men, and disgust, especially by the women, predicted later marital dissatisfaction and even divorce.

Facial signals of emotion as regulators of social interaction. Facial expressions of emotion, and other facial behaviors, are important regulators of social interaction. In the developmental literature, this concept has been investigated under the rubric of social referencing (Klinnert, Campos, & Sorce, 1983); that is, the process whereby infants seek out emotional information from others to disambiguate a situation and then use that information to act. The strongest demonstration of social referencing comes from work on the visual cliff. In the first study to investigate social referencing in the visual cliff, Campos and his colleagues (Sorce, Emde, Campos, & Klinnert, 1985) placed mothers on the far end of the cliff from the infant. Mothers first smiled to the infants and placed a toy on top the safety glass to attract them; infants invariably began crawling to their mothers. When the infants were in the center of the table, however, the mother then posed an expression of either fear, sadness, anger, interest, or joy, corresponding to the expressions published by Ekman and Friesen (1975) and Izard (1971). The results showed clearly different results for the different faces. No infant crossed the table when the mother showed fear; only 1 (of 17) did when the mother posed anger. Only 33% crossed when the mother posed sadness, and approximately 75% of the infants crossed when the mother posed joy or interest. Other studies provide similar support for facial expressions as regulators of social interaction in this paradigm (Bradshaw, 1986; Campos, Thein, & Owen, 2003; Hertenstein & Campos, 2004).

Summary. Not surprisingly, the social value of facial expressions has been shown in other primate species as well. Miller and his colleagues (Miller, Banks, & Kuwahara, 1966; Miller, Banks, & Ogawa, 1963; Miller, Caul, & Mirsky, 1967; Miller, Murphy, & Mirsky, 1959) demonstrated that monkeys shown a facial expression of distress by a partner will perform a conditioned task more readily than a monkey shown a neutral expression. Miller's paradigm, in fact, was the basis for an early measure in the human emotional intelligence domain developed by Buck (1976). Itakura (1993) reported a different contingency learning study with a female chimp who showed negative emotional behaviors when she made an error. Collectively, these studies demonstrate that the social value of discrete facial expressions of emotion have analogs in both human and nonhuman primates.

Facial Affect Reciprocity in Interpersonal Interactions

Definition. Although the research described immediately above highlights the interpersonal functions of emotion, research on those functions is still in its infancy. Here, I propose a new concept that I suggest is crucial to interpersonal interactions and relationships—

Facial Affect Reciprocity (FAR). Below I define this concept and discuss its theoretical implications to interpersonal relationships and teamwork.

FAR refers to the *exchange* of facial expressions among interactants across time and the *linkage* between specific types of emotion. Emotions and their expressions do not occur in a vacuum; emotions often occur in social situations because emotions evolved precisely in order to aid in solving problems related to social coordination. Emotions and their expressions certainly do have intrapersonal meaning to an individual, as described above; but they also have signal value, providing valuable information to others, also as described above. FAR suggests that, in normal discourse, receivers also have emotional reactions to the senders and thus become senders themselves. Original senders thereby become receivers and then again become senders. Emotional expressions, therefore, are bounced back and forth continuously between two or more interactants as if they play catch with emotions (Matsumoto, 2007).

While single emotions signal something important about the characteristics of the individual expresser, FAR suggests that the specific *combinations of facial expressions among interactants* signal something important about the nature of the interaction and relationship. FAR likely can signal the nature and quality of the relationship occurring between strangers, acquaintances, friends, and partners. FAR can also likely signal the efficiency of the performance of groups on tasks. I theorize that FAR adds additional explanatory power, over and above individual emotions, to these kinds of relationships and group variables.

The concept of emotion reciprocity is not new in the literature. Studies have documented its importance in marriage (Gottman & Levenson, 2002; Notarius & Johnson, 1982), mother-child relationships (Lindsey, MacKinnon-Lewis, Campbell, Frabutt, & Lamb, 2002), and family processes (Cook, Strachan, Goldstein, & Miklowitz, 1989). These findings converge with others demonstrating the existence and function of mirror neurons for social behaviors (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Rizzolatti & Craighero, 2004), and especially those mirror neurons specialized for processing faces and emotional expressions (Carr, Iacobini, Dubeau, Mazziota, & Lenzi, 2003; Nakamura et al., 1999) that may serve as the basis for empathy. Studies documenting the importance of emotion reciprocity are also consistent with studies on emotion contagion (Hatfield, Cacioppo, & Rapson, 1992, 1994), and facial mimicry (Dimberg & Ohman, 1996; Hess & Blairy, 2001). Greater affective fit among team members has been associated with more positive attitudes about group relations and perceptions of greater influence within groups (Barsade, Ward, Turner, & Sonnenfeld, 2000).

But while the notion of emotion reciprocity is not new to the literature, the concept of FAR is. I suggest that FAR is more relevant to interpersonal interactions because it is based on visibly observable universal expressions. Because expressions have signal value, these should be more directly related to interaction and relationships than simply internal feeling states or physiological responding as interactants respond, often unconsciously, not only to the exchanged words but also to the communicated nonverbal signals.

In fact, research has demonstrated how facial affect responding can reflect the course of cooperative behavior in interactions and signal something important about the quality of those relationships. Gottman and colleagues (Carstensen, Gottman, & Levenson, 1995; Gottman,

Coan, Carrere, & Swanson, 1998), for instance, measured the facial emotions of married couples and showed that unhappy couples showed more Negative Continuance—the expression of a negative emotion by one partner followed by a negative expression in response; and Negative Start-Up. Krause and colleagues (Anstadt, Merten, Ullrich, & Krause, 1997; Merten, Anstadt, Ullrich, Krause, & Buchhelm, 1996) demonstrated that complementary and reciprocal facial affect responses between psychotherapists and their clients differentially indicated aspects of the course of treatment. Years earlier, Matsumoto and colleagues (1986) showed that the facial expressions of emotion of preschoolers playing Prisoner's Dilemma not only were affected by the plays, but also predicted subsequent plays. In a more recent study, Schug and colleagues (2009) showed that facial expressions predicted whether players would reject unfair offers from others when playing the Ultimatum Game and fair offers in a subsequent condition of the game. This was also found in Matsumoto et al.'s (1986) study with preschoolers and suggests that a forgiveness or acceptance dimension is important to subsequent cooperative relationships and behaviors. Cumulatively, these studies highlight the potential importance of FAR and its impact on social interactions.

Types of FAR. Because at least seven emotions are universally expressed in the face, and other emotions are probably displayed via other nonverbal and verbal behaviors, the potential number of sequential combinations of expressed emotions between any two or more interactants is large. For simplicity's sake, I present in Table 1 the possible expression combinations of two individuals based on a classification of each expression as either positive, negative, mixed (showing both positive and negative emotions), or neutral, and provide a label for each.

- Positive Reciprocation: Both individuals display positive expressions
- Negative Reciprocation: Both individuals display negative expressions
- Neutral Reciprocation: Both individuals display neutral expressions
- Mixed Reciprocation: Both individuals display a mix of positive and negative expressions
- Positive Non-Reciprocation: One individual displays positive expressions but the other displays neutral expressions
- Negative Non-Reciprocation: One individual displays negative expressions but the other displays neutral expressions
- Positive Ambivalent Reciprocation: One individual displays positive expressions but the other displays a mixture of positive and negative emotions
- Negative Ambivalent Reciprocation: One individual displays negative expressions but the other displays a mixture of positive and negative emotions
- Neutral Ambivalent Reciprocation: One individual displays neutral expressions but the other displays a mixture of positive and negative emotions
- Conflicting Reciprocation: One individual displays positive expressions but the other displays negative expressions

Table 1

Characterizations of Facial Affect Reciprocity According to Expressions Displayed by a Dyad

		Expression by Person A			
		Positive	Neutral	Negative	Mixed
Expression by Person B	Positive	Positive Reciprocation	Positive Non-Reciprocation	Conflicting Reciprocation	Positive Ambivalent Reciprocation
	Neutral		Neutral Reciprocation	Negative Non-Reciprocation	Neutral Ambivalent Reciprocation
	Negative			Negative Reciprocation	Negative Ambivalent Reciprocation
	Mixed				Mixed Reciprocation

Implications for group functioning. A host of factors have been shown to influence group relationships and performance (reviewed in Pelled, Eisenhardt, & Xin, 1999). Of particular interest in recent years has been the impact of emotional intelligence in groups and work teams (Ashkanasy & Daus, 2005; Daus & Ashkanasy, 2005; Jordan & Troth, 2004). Higher emotional intelligence within teams has been linked to better team performance and conflict resolution. There are many facets of emotional intelligence and one of the facets concerns the use of emotional expressions. How an individual responds to another person's emotional displays can have a dramatic effect on efficiency and cooperation. How one uses emotional displays in the first place can also influence the behaviors and attitudes of others. Effective leaders, in particular, know how to read the emotions of their subordinates and to express emotions to deescalate conflict, motivate individuals, or maintain team performance (Sosik & Megerian, 1999).

In terms of the types of FAR described earlier, I hypothesize that team performance and function will be positively associated with Positive Reciprocation (both individuals display positive emotions) and negatively with Negative Reciprocation (both individuals display negative emotions). During task performance, negative emotions can be harmful to intragroup cooperation and individual motivation and performance. Increased Positive Reciprocity and decreased Negative Reciprocity may be two emotional processes that aid in the resolution of the negative emotions of one of the team members, thereby resetting emotional states to a baseline, or even positively, which should therefore aid in team performance and function.

I also hypothesize that team performance will diminish with any FAR variable involving mixed emotions (e.g., Mixed Reciprocity; Positive, Negative, or Neutral Ambivalent Reciprocity). Mixed emotions are likely to signal mixed intentions to observers, thereby rendering those signals less honest and more ambiguous. The unreliability of such signals should only serve to enhance the negative effects of those states, thereby being detrimental to performance and function.

Overview of the Investigations

I conducted three investigations that examine this new theoretical framework and specifically test the hypotheses described above, using dyadic pairs playing an interactive game that requires cooperation and adaptation, and that generates objective performance data. Task 1 involved same sex stranger dyads including only U.S.-born-and-raised Americans, who participated under standard conditions with ample time for decision and responses; we considered this study to be the Control Condition. Task 2 also involved same sex stranger dyads, but all pairs were intercultural; one individual was a U.S.-born-and-raised American, while the other was a foreign-born international student. All other conditions were the same as for Task 1; we considered this study as the Intercultural Condition. Task 3 involved same sex stranger dyads including only U.S.-born-and-raised Americans, but these dyads participated in very quick rounds and were instructed to be selfish; we considered this study the Stress Condition. The game used in all investigations was a modified version of Prisoner's Dilemma; this game was chosen because it is one of the most well-known and commonly used games in the cooperation and trust literature. While it is easily programmable into a computer game, we opted to play the game in real time and in person to maximize the interactions effects on emotions and expressions.

Although three investigations were conducted, for parsimony we report the data from all three investigations below in a combined analysis, referring to the three investigations as the conditions described.

Method

Game

Description. Participants completed a modified Prisoner's Dilemma (PD) game. During the consenting procedures, participants were instructed that they would be seated opposite each other at a table and that an experimenter would be seated on one side of the table. Each participant was given 20 $1 coins and a yellow and a blue card. Participants were told that they had to decide whether to play the blue or yellow card within the time allotted for each play, that there would be a divider on the table that prevented the players from seeing the other side of the table, and that payoffs would occur at the end of each round according to the schedule shown in Table 2.

Table 2

Matrix of Payoffs According to Plays by the Dyad

Player 1	Player 2	Player 1 Payoff	Player 2 Payoff
Blue	Blue	– $4	– $4
Blue	Yellow	+ $2	– $2
Yellow	Blue	– $2	+ $2
Yellow	Yellow	+ $1	+ $1

A member of the research team delivered these instructions to the dyad in a consenting room. All participants acknowledged their understanding of the instructions and payoffs prior to being led to a separate experimental room, where they met the experimenter who was blind to the nature of the participant conditions.

Once the players and the experimenter were settled, play began. The experimenter placed the divider and announced the start of the round and pressed a stopwatch. At the end of each round the experimenter announced "stop," lowered the divider, and announced the payoffs. Players who lost money handed it to the experimenter; players who gained money received it from the experimenter. Once payoffs were completed, the experimenter raised the divider and began the next round in the same manner. Play continued for 20 rounds, or until one of the players had lost all of his or her money.

Individual-level dependent variables. A number of behaviorally-based outcome variables were extracted from the plays:

- Total Yellow card plays. Playing the yellow card was indicative of cooperation, trust, and vulnerability.
- Total Blue card plays. Playing the blue card was indicative of competitiveness, aggressiveness, or betrayal.
- Total # of trials.
- Total dollar payoffs for self, other, and dyad.

In addition, we created the following ten individual play characterizations:

- Cooperation (played Yellow after previous Yellow of both players)
- Betrayal (played Blue after the previous Yellow of both players)
- Forgiveness (played Yellow after Blue played against you and you played Yellow)
- Retaliation (played Blue after Blue played against you when you played Yellow)
- Reparation (played Yellow after playing Blue when Yellow was offered)
- Defection (played Blue after playing Blue when Yellow was offered)
- Reconciliation (played Yellow after playing Blue when Blue was played against you)
- Stalemate (played Blue after playing Blue and Blue was played against you)
- Prosocial Acts (Sum of Cooperation, Forgiveness, Reparation, and Reconciliation)
- Antisocial Acts (Sum of Betrayal, Retaliation, Defection, and Stalemate)

Dyad-level dependent variables. We also created a dyad-level data set, in which dyads were the unit of analysis. In this data set, we computed totals for both players on the behavioral outcomes described above in Individual-Level Dependent Variables. We also computed the following unique dyad-level play characterizations, based on the individual play characterizations of each player:

- Collaboration (both players engaged in Cooperation)
- Distrust (one player Cooperated while the other Betrayed)

- Standoff (both players engaged in Betrayal)
- Sociable (one player engaged in Reparation while the other engaged in Forgiveness)
- Dysfunctional (one player Defected while the other engaged in Forgiveness)
- Disconnection (one player Retaliated while the other engaged in Reparation)
- Ruination (one player Defected while the other Retaliated)
- Negotiation (both players engaged in Reconciliation)
- Impasse (one player Reconciled while the other engaged in Stalemate)
- Destruction (both players engaged in Stalemate)

Participants and Conditions

There were three between-subjects conditions of play conducted in three separate tasks; for the purpose of this report, we combine them into a single analysis. All dyads were same sex strangers. Task 1 (the Control Condition) included 120 U.S.-born-and-raised Americans (40 males, 80 females, mean age = 23.22). Task 2 (the Intercultural Condition) included 41 U.S.-born-and-raised Americans (20 males, 21 females, mean age = 23.23) and 41 non-US-born-and-raised international students (20 males, 21 females, mean age = 25.27). The international students were all born and raised in another country (Argentina $n = 1$, Brazil $n = 1$, Bulgaria $n = 1$, China $n = 7$, Egypt $n = 1$, Ethiopia $n = 1$, Greece $n = 1$, Hong Kong $n = 2$, India $n = 3$, Iran $n = 1$, Japan $n = 2$, Kenya $n = 1$, Malaysia $n = 3$, Mexico $n = 1$, Nepal $n = 1$, Nicaragua $n = 2$, Peru $n = 2$, Philippines $n = 2$, Russia $n = 3$, South Korea $n = 3$, Spain $n = 1$, and Taiwan $n = 1$) and spoke a non-English language as their first and primary language. Task 3 (the Stress Condition) included 90 U.S.-born-and-raised Americans (44 males, 46 females, mean age = 22.26).

Participants were given the general instructions that they will be playing a game with a partner in which they will both be trying to increase their participation fee, but that there was also the possibility that their participation fee decreased. That is, they were told that the final amounts they ended up with depended on their play. In reality, this was a ruse, and all participants were given a standard participation fee. Participant debriefing indicated that all participants believed the ruse.

Detailed instructions and procedures differed across the conditions. Participants in the Control and Intercultural Conditions were both instructed to increase their original payoffs, and they would receive as their participation fee whatever they ended up with at the completion of play; each round lasted for 20 s. Participants in the Stress Condition were instructed that one participant had to win over the other, and that the winner at the end would get all the coins from the loser, while the losing participant would get nothing; each round lasted for 4 s.

Cultural and Geographic Distance Scores

For the Intercultural Condition only, we computed Cultural Distance scores for each dyad by computing the absolute difference between the two players' native country scores on each of Hofstede's (2001) five cultural dimensions: Individualism vs. Collectivism, Power Distance, Uncertainty Avoidance, Masculinity vs. Femininity, and Long vs. Short Term Orientation. We also computed Geographical Distance scores by computing as the crow flies difference scores between San Francisco (the site of the data collection) and the capital city of each of the International Students' home countries.

Personality

All participants completed the Neo-Five Factor Inventory (NEOFFI; Costa & McCrae, 1989, 1992), a 60-item version of form S of the NEO-PI-R that provides a measure of the five factor model: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Convergent and discriminant validity was excellent. All αs were within the acceptable ranges for all scales for all studies (Table 3).

Table 3

Cronbach's Alphas for the NEOFFI, EES, and Self-Reported Emotions, All Tasks

	Task 1 (Control)	Task 2 (Intercultural; Total Group)	Task 2 (Americans)	Task 2 (International Students)	Task 3 (Stress)
Self-Reported Emotions Pretest	.778	.752	.770	.744	.743
Self-Reported Emotions Posttest	.710	.766	.717	.803	.638
NEOFFI Neuroticism	.838	.852	.823	.876	.848
NEOFFI Extraversion	.790	.721	.752	.692	.830
NEOFFI Openness	.731	.752	.754	.644	.754
NEOFFI Agreeableness	.680	.795	.837	.722	.785
NEOFFI Conscientiousness	.836	.856	.896	.793	.862
EES	.920	.890	.879	.897	.947

All participants also completed the Emotional Expressivity Scale (EES; Kring, Smith, & Neale, 1994), a measure of their trait level expressivity. The EES is a 17-item scale asking participants to self-report how they deal with emotional expressions. Sample items are "I don't express my emotions to other people," "I can't hide the way I am feeling," and "Even if I am feeling very emotional, I don't let others see my feelings." Respondents use a 6-point scale, anchored 1, *Never True*; 2, *Rarely True*; 3, *Occasionally True*; 4, *Usually True*; 5, *Almost Always True*; and 6, *Always True*. Alphas were high and acceptable for all groups in all studies (Table 3).

Self-Reported Emotions

Participants self-reported their emotional states using 9-point scales anchored 0, *not experiencing the emotion at all* to 8, *the most intense feeling of this emotion that a person could ever feel*. The emotions rated included anger, contempt, disgust, fear, happiness, sadness, surprise, pride, shame, embarrassment, guilt, interest, and other (with participant completion). These scales were completed twice, once at the end of the consent procedures prior to going to the experimental room, and a second time immediately after the completion of the experiment and the beginning of the debrief. Alphas were high and acceptable for all groups in all studies for both pretests and posttests (Table 3).

Videotaping and Facial Measurement

All experimental sessions were video recorded by three high-speed cameras. One camera was positioned behind each of the players to record the other player's facial behaviors. The third camera was positioned at a 90-degree angle to the two players, recording the experimenter's behaviors and game play. All video feeds were synchronized using a common time-code generator.

The facial behaviors of each of the players were coded using a modified version of the Facial Action Coding System (FACS; Ekman & Friesen, 1978). FACS identifies each of the functionally anatomical facial muscle movements (action units or AUs) that can occur independently, as well as head and eye positions. A team of three certified FACS coders who were blind to the hypotheses and goals of the effort coded all behaviors. FACS codes were arbitrated among the coding team with an expert FACS coder, and the PI adjudicated any remaining questionable codes. Reliability among pairs of coders was acceptable (range = .75 to .80).

The coding instructions were modified so that coders did not code all available FACS codes, but instead coded only those AUs that have been theoretically or empirically related to emotion signaling. All coded AU combinations were compared to the Emotion FACS (EMFACS) dictionary to obtain emotion predictions (Ekman & Friesen, 1982; Matsumoto, Ekman, & Fridlund, 1991). The dictionary was accessed via a computer program available to all researchers who have FACS data (Levenson, 2005). EMFACS identifies AUs that are theoretically related to facial expressions of emotion posited by Darwin (1872) and later Tomkins (1962, 1963), and empirically verified by studies of spontaneous expression and judgments of expressions by Ekman and colleagues over 20 years (Ekman et al., 1990; Ekman &

Friesen, 1971; Ekman, Friesen, & Ancoli, 1980; Ekman, Friesen, & Ellsworth, 1972; Ekman, Friesen, & O'Sullivan, 1988; Ekman, Sorenson, & Friesen, 1969). The facial configurations associated with the emotion predictions were first listed in Ekman (1972), and in the original FACS Manual (Ekman & Friesen, 1978). Prototypic examples of the emotion facial configurations are described in Ekman and Friesen's (1975) *Unmasking the Face*, and portrayed in their *Pictures of Facial Affect* (Ekman & Friesen, 1976) and the *Japanese and Caucasian Facial Expressions of Emotion* (Matsumoto & Ekman, 1988) sets. The EMFACS dictionary has been used in many published studies (Berenbaum & Oltmanns, 1992; Ekman et al., 1990; Ekman, Matsumoto, & Friesen, 1997; Keltner et al., 1995; Matsumoto et al., 1986; Rosenberg & Ekman, 1994; Rosenberg, Ekman, & Blumenthal, 1998; Rosenberg et al., 2001; Steimer-Krause, Krause, & Wagner, 1990), as well as in studies that used FACS and then virtually the same dictionary codes to produce emotion predictions but did not mention EMFACS (Chesney, Ekman, Friesen, Black, & Hecker, 1990; Ekman et al., 1988; Frank et al., 1993; Gosselin, Kirouac, & Dore, 1995; Heller & Haynal, 1994; Keltner, 1995; Levenson, Carstensen, Friesen, & Ekman, 1991; Messinger, Fogel, & Dickson, 2001; Ruch, 1993, 1995; Sayette et al, 2003). The results of many of these more recent studies were used to adjust the EMFACS emotion predictions. The classifications resulted in predictions for the following emotions and expressions:

- anger
- contempt
- disgust
- fear
- joy (enjoyment smiles; also known as Duchenne smiles)
- sadness
- surprise
- social smiles (non-enjoyment smiles; also known as non-Duchenne smiles)

Enjoyment and non-enjoyment smiles differ in several respects. In this effort they were differentiated according to the presence or absence of the activation of orbicularis oculi, the muscle surrounding the eyes. Previous research has demonstrated that this muscle is innervated (along with the smiling muscle, zygomatic major) when individuals experience true positive emotion, such as amusement or enjoyment (Frank et al., 1993). Social smiles, however, typically do not involve the activation of this muscle. Even though social smiles are technically not emotional expressions, we include them in the analyses below.

The emotion predictions for each coded event for each player were then placed on a standard time log for both players of a dyad, so that their individual emotion signaling across time could be observed. We then classified each individual's emotional expressions into one of the four following categories:

- Positive (any occurrence of a smile; can occur with surprise)
- Negative (any occurrence of anger, contempt, disgust, fear, sadness, or undifferentiated negative; can occur with surprise)
- Mixed (any occurrence of a combination of a smile and any negative emotion)
- Neutral (no emotional expressions occurred)

Based on the *combination* of the dyad's emotional expressions, we then classified the combination into one of the following categories presented originally in Table 1:

- Positive Reciprocation (both players express positive emotions only)
- Positive Non-Reciprocation (one player expresses positive emotions, the other expresses no emotional expressions)
- Conflicting Reciprocation (one player expresses positive emotions while the other expresses negative emotions)
- Positive Ambivalent Reciprocation (one player expresses positive emotions while the other expresses mixed emotions)
- Neutral Reciprocation (both players express no emotional expressions)
- Negative Non-Reciprocation (one player expresses negative emotions while the other expresses no emotions)
- Neutral Ambivalent Reciprocation (one player expresses mixed emotions while the other remains neutral)
- Negative Reciprocation (both players express negative emotions)
- Negative Ambivalent Reciprocation (one player expresses negative emotions while the other expresses mixed emotions)
- Mixed Reciprocation (both players express mixed emotions)

These classifications were produced separately for each play period (i.e., when the players were deciding what card to play during the 20 or 4 s time periods), and the reaction times (the period after the play period when the results of the play are shown and payoffs are made). Total dyadic scores on each of the reciprocity variables above were thus computed across all play times, all reaction times, and total.

Further, each individual player's overall frequency of each of the emotional expressions was computed and used in the analyses below.

Results

Preliminary Analyses

Individual-level behavioral outcomes and differences as a function of condition. We computed one-way Analysis of Variances (ANOVAs) on each of the individual-level play characterizations, using Condition as an independent variable, and conducted post-hoc comparisons using Scheffe tests. The Control Condition had a greater number of Total Yellow Plays, Total # of Trials, Total Dollar Payoffs, and Prosocial Acts than the Intercultural and Stress conditions, while there were no differences between the latter conditions. Moreover, the Intercultural and Stress Conditions had a greater number of Total Blue Plays, Retaliation, Defection, Stalemate, and Antisocial Acts than the Control Condition (Table 4). Essentially the Intercultural Condition looked like the Stress Condition, producing far worse behavioral outcomes than the Control Condition, despite the Intercultural Condition having the same instructions and procedures as the Control Condition.

Table 4

Individual-Level Differences in the Behavioral Outcomes as a Function of Task (Condition)

Behavioral Outcome		Task 1 Control	Task 2 Inter-cultural	Task 3 Stress	*F*(2, 291)	*p*	Scheffe
Total Yellow Plays	*M*	14.03	10.12	9.40	21.24	.00	Control > Intercultural = Stress
	SD	5.41	6.13	5.23			
Total # of Trials	*M*	18.55	16.24	16.40	11.06	.00	Control > Intercultural = Stress
	SD	2.87	4.81	4.41			
Total Self Payoff	*M*	24.05	16.39	11.97	18.89	.00	Control > Intercultural = Stress
	SD	15.23	14.54	13.19			
Total Partner Payoff	*M*	24.05	16.39	12.01	18.76	.00	Control > Intercultural = Stress
	SD	15.23	14.54	13.20			
Total Dyad Payoff	*M*	48.10	32.78	23.98	22.18	.00	Control > Intercultural = Stress
	SD	29.19	25.63	23.67			
Total Cooperation	*M*	9.19	4.94	3.84	22.13	.00	Control > Intercultural = Stress
	SD	7.05	6.04	4.98			
Total Prosocial Acts	*M*	13.18	9.41	8.72	20.87	.00	Control > Intercultural = Stress
	SD	5.30	5.94	5.04			
Total Betrayal	*M*	1.51	1.33	1.77	1.78	ns	
	SD	1.47	1.55	1.61			
Total Forgiveness	*M*	1.38	1.62	1.57	0.56	ns	
	SD	1.47	1.96	1.74			
Total Reparation	*M*	1.87	2.02	1.91	0.19	ns	
	SD	1.77	1.92	1.73			
Total Blue Plays	*M*	4.53	6.12	7.00	15.03	.00	Control < Intercultural = Stress
	SD	3.66	3.16	2.97			
Total Retaliation	*M*	1.23	1.74	1.80	5.19	.01	Control < Intercultural = Stress
	SD	1.37	1.38	1.56			
Total Defection	*M*	0.74	1.34	1.44	8.43	.00	Control < Intercultural = Stress
	SD	1.23	1.53	1.32			
Total Stalemate	*M*	0.90	1.41	1.62	7.41	.00	Control < Intercultural = Stress
	SD	1.34	1.44	1.46			
Total Antisocial Acts	*M*	4.38	5.83	6.63	13.31	.00	Control < Intercultural = Stress
	SD	3.56	3.04	2.88			
Total Reconciliation	*M*	0.73	0.83	1.40	11.77	.00	Control = Intercultural < Stress

Because scores in the Intercultural Condition were similar to the scores in the Stress Condition, we considered whether the American or international student participants played more or less cooperatively by computing one-way ANOVAs on each of the same dependent variables, using nationality (U.S. vs. International) as the independent variable using the Intercultural Condition only. None of the tests were significant. It was not the case that either group played more or less cooperatively than the other.

We also considered whether plays started out cooperatively (or not) and then changed across the trials for the Intercultural Condition. We cross-tabulated nationality with Yellow or Blue card play, separately for each trial. Of the 20 trials, only two produced statistically significant effects. Thus it was not the case that either group changed across the trials either.

Dyadic-level differences in behavioral outcomes as a function of condition. We computed one-way ANOVAs on each of the dyadic-level play characterizations, using Condition as an independent variable, and conducted post-hoc comparisons using Scheffe tests. The Control Condition had a greater Dyad Collaboration and Total Prosocial Acts, while the Intercultural and Stress Conditions had a greater number of Antisocial Acts. Additionally, the Intercultural Condition had more Dyad Dysfunction than the other two conditions; the Stress Condition had more Dyad Ruination than the other two conditions; the Stress Condition had more Dyad Negotiation than the Intercultural Condition; and the Stress Condition had more Dyad Impasse than the Control Condition (Table 5).

Table 5

Dyadic-Level Differences in the Behavioral Outcomes as a Function of Task (Condition)

		Task 1 Control	Task 2 Intercultural	Task 3 Stress	*F*(2, 143)	*p*	Scheffe
Dyad Collaboration	*M*	8.15	4.05	2.71	10.61	.00	Control > Intercultural = Stress
	SD	7.48	6.02	4.77			
Total Prosocial Acts	*M*	26.35	18.83	17.44	11.01	.00	Control > Intercultural = Stress
	SD	10.45	11.47	9.73			
Dyad Distrust	*M*	2.08	1.78	2.24	0.66	ns	
	SD	1.89	1.84	1.98			
Dyad Standoff	*M*	0.47	0.44	0.64	0.97	ns	
	SD	0.79	0.74	0.74			
Dyad Sociable	*M*	2.08	1.83	2.02	0.81	ns	
	SD	1.94	1.76	1.90			
Total Antisocial Acts	*M*	8.75	11.66	13.27	7.99	.00	Control < Intercultural = Stress
	SD	6.86	5.14	5.03			
Dyad Dysfunctional	*M*	0.68	1.41	1.11	3.63	.03	Intercultural > Control = Stress
	SD	1.20	1.72	1.21			
Dyad Disconnection	*M*	1.65	2.22	1.82	0.88	ns	
	SD	2.07	2.42	1.92			
Dyad Ruination	*M*	0.80	1.27	1.78	8.84	.00	Stress > Control = Intercultural
	SD	1.12	1.12	1.31			
Dyad Negotiation	*M*	0.38	0.22	0.67	4.89	.01	Intercultural > Stress
	SD	0.64	0.47	0.85			
Dyad Impasse	*M*	0.70	1.22	1.44	7.13	.00	Stress > Intercultural
	SD	0.93	1.13	1.10			
Dyad Destruction	*M*	0.55	0.80	0.91	1.62	ns	
	SD	0.96	1.03	1.20			

Changes in self-reported emotions. We computed a Condition (3) x Time (Pre vs. Post) x Emotion (12) ANOVA on the self-reported emotion scale ratings. The three-way interaction was significant, $F(22, 2893) = 1.70$, $p < .05$, $\eta_p^2 = .013$. Simple effects analyses of Time indicated that for the Control Condition, ratings of fear and interest decreased from pre to post, while ratings of happiness, surprise, and pride increased. The Stress Condition indeed produced stressful reactions, as ratings of fear and interest decreased while ratings of anger, contempt, disgust, sadness, surprise, and shame increased (all *p*s < .05). Interestingly, the Intercultural Condition produced changes that were exactly the same as those in the Control Condition. Thus, although the behavioral outcomes were vastly different between the Control and Intercultural Conditions, the self-reported emotional changes were not.

We also examined the emotional changes within the Intercultural Condition by computing simple effects of time for each emotion scale separately for Americans and International Students. For both groups, fear decreased while surprise increased from pre to post. But the American students also increased in contempt; the International Students had increases in happiness and pride and decreases in guilt (all *p*s < .05). Thus, although the behavioral data were strikingly similar for these groups, their emotional profiles were different.

Descriptive analyses on facial expressions of emotion and facial reciprocity data. To ensure that participants expressed sufficient emotions on their faces to conduct analyses, we computed the frequencies of each of the emotion expression predictions produced by EMFACS (Table 6). There were relatively low frequencies of anger, disgust, fear, enjoyment smiles, sadness, and surprise, but relatively high frequencies of contempt and non-enjoyment smiles. When collapsed into the positive-negative distinction, which was used to create FAR variables, however, the overall summed frequencies of the various specific emotional expressions were able to produce a not insubstantial amount of both positive and emotion signaling. Thus the analyses below were not confounded by a lack of emotion signaling by the players.

Table 6

Descriptive Statistics for Facial Expressions of Emotion

		Task 1 Control	Task 2 Intercultural	Task 3 Stress
Anger	*M*	1.85	0.84	0.35
	SD	2.67	1.73	1.35
Contempt	*M*	19.57	14.25	6.31
	SD	19.37	13.65	6.78
Disgust	*M*	2.21	1.20	0.56
	SD	3.44	2.53	1.47
Fear	*M*	0.40	0.66	0.19
	SD	1.12	2.62	0.63
Enjoyment	*M*	1.92	1.45	1.86
	SD	3.68	2.48	3.22
Non-Enjoyment	*M*	20.29	13.76	9.89
	SD	21.65	13.02	10.50
Sadness	*M*	2.05	2.09	1.07
	SD	4.35	4.74	2.18
Surprise	*M*	1.04	0.33	0.24
	SD	2.29	0.72	0.64
Positive	*M*	22.20	15.21	11.75
	SD	25.33	15.50	13.72
Negative	*M*	26.08	19.04	8.48
	SD	30.95	25.27	12.41

Main Analyses

Analysis plan. To examine whether any of the FAR variables predicted the behavioral outcomes, we computed hierarchical multiple regressions on each of the outcomes using the dyad-level data, entering both players' individual-level frequencies on each of the facial expression variables on the first step, and the FAR variables on the second. Stepwise entry criteria were used at both steps, ensuring that only those variables that added significantly to the prediction of the outcome variable were entered. The inclusion of the individuals' facial expression frequencies on the first step ensured that the findings on the second step controlled for any effects of individual-level expressions.

Moreover, these analyses were conducted separately using FAR variables computed during the Play periods (that is, the timed periods when participants made their decisions about which card to play) and the Reaction periods (the period in between plays when players saw the results of the previous play and payoffs occurred). We also conducted the analyses using FAR variables across both Play and Reaction periods (Total). Minor differences in the findings

occurred across the analyses; there were substantial consistencies, however, in the main findings. For parsimony, we report in text below only those findings using the Total FAR variables; detailed tables of findings for the Play and Reaction periods are also included in the tables below.

Findings, Control Condition (Task 1). Table 7 presents statistics from the final step of the regressions for the Control Condition. The R^2_{change} statistic represents the percentage of variance accounted for by all of the FAR variables, above and beyond what was accounted for by individual facial expressions; it was computed by taking the difference from the R^2 on the final step of each regression and the R^2 associated with the last individual facial expression variable entered into the regression on the first step.

Table 7

Results of Hierarchical Multiple Regressions, Task 1

Total Facial Affect Reciprocity Scores				
Behavioral Outcomes	Final *R*	R^2_{chg}	Significant Facial Affect Reciprocity Variables	Beta
Yellow-Yellow Plays	.661***	.366	Neutral	.723
			Neutral Ambivalent	.221
			Negative	.426
			Positive Ambivalent	.494
			Positive Non	.381
Yellow-Blue Plays	.566***	.158	Neutral ambivalent	–.319
			Mixed	.294
Blue-Yellow Plays	.399*	.101	Mixed	.325
Blue-Blue Plays	ns	ns	ns	ns
Total # Trials	.999***	.998	Conflicting	.416
			Neutral	1.454
			Positive Non	.715
			Neutral Non	1.181
			Positive Ambivalent	.828
			Negative Ambivalent	.469
			Positive	.681
			Neutral Ambivalent	.507
			Negative	.555
			Mixed	.559
Total Dyad Dollar Payoff	.704***	.496	Neutral	.886
			Conflicting	.406
			Positive	.451
			Negative	.357

Table 7 (continued)

			Neutral Ambivalent	.344
			Neutral Non	.585
			Positive Ambivalent	.601
			Positive Non	.353
Dyad Collaboration	.631***	.329	Neutral	.689
			Neutral Ambivalent	.184
			Negative	.432
			Positive Non	.369
			Positive Ambivalent	.444
Dyad Distrust	.528***	.054	Mixed	.243
Dyad Standoff	ns		ns	ns
Dyad Sociable	.339*		None	.339
Dyad Dysfunctional	.293*	.086	Neutral Ambivalent	.293
Dyad Disconnection	.616***	.147	Mixed	.359
			Neutral Ambivalent	–.249
Dyad Ruination	.334*	.053	Neutral Ambivalent	–.232
Dyad Negotiation	.588***		None	.497
Dyad Impasse	.499**	.193	Conflicting	–.378
			Neutral	–.313
			Positive	–.268
Dyad Destruction	.384*		None	.291
Facial Affect Reciprocity Scores During Play Only				
Yellow-Yellow Plays	.644***	.346	Neutral	.650
			Positive Ambivalent	.457
			Conflicting	.344
			Negative	.446
			Positive Non	.230
Yellow-Blue Plays	.403*		None	.334
Blue-Yellow Plays	.241+		None	.241
Blue-Blue Plays	.586***	.343	Positive	–.291
			Conflicting	–.421
			Neutral	–.541
			Positive Ambivalent	–.351
			Negative	–.351
Total # Trials	.998***	.907	Conflicting	.538
			Positive	.481
			Neutral	1.523
			Neutral Non	1.284
			Neutral Ambivalent	.558
			Positive Ambivalent	.683

Table 7 (continued)

			Negative	.852
			Negative Ambivalent	.631
			Positive Non	.690
			Mixed	.595
Total Dyad Dollar Payoff	.280*	.078	Positive	.280
Dyad Collaboration	.586***	.274	Neutral	.599
			Positive Ambivalent	.472
			Negative	.369
			Conflicting	.265
Dyad Distrust	.475***		None	.421
Dyad Standoff	.234+	.055	Positive	–.234
Dyad Sociable	.339*		None	.339
Dyad Dysfunctional	.248+	.062	Neutral Non	.248
Dyad Disconnection	.596***	.122	Mixed	.348
			Negative Ambivalent	–.258
Dyad Ruination	.344*	.060	Positive	–.246
Dyad Negotiation	.588***		None	.497
Dyad Impasse	.584***	.285	Positive	–.334
			Conflicting	–.418
			Neutral	–.278
Dyad Destruction	.468**	.071	Positive	–.274
Facial Affect Reciprocity Scores During Reaction Only				
Yellow-Yellow Plays	.778***	.536	Neutral	.984
			Neutral Ambivalent	.555
			Positive Non	.561
			Negative	.506
			Positive Ambivalent	.768
			Positive	.551
			Neutral Non	.611
			Conflicting	.210
Yellow-Blue Plays	.561***	.150	Neutral Ambivalent	–.277
			Mixed	.271
Blue-Yellow Plays	.415**	.114	Mixed	.341
Blue-Blue Plays	ns	ns	ns	ns
Total # Trials	.299*		None	.299
Total Dyad Dollar Payoff	ns		ns	ns
Dyad Collaboration	.466**	.148	Mixed	–.294
			Neutral Ambivalent	.225
Dyad Distrust	.543***	.069	Mixed	.282

Table 7 (continued)

Dyad Standoff	.262+	.069	Positive Ambivalent	.262
Dyad Sociable	.434**	.073	Mixed	.272
Dyad Dysfunctional	.271*	.073	Neutral Ambivalent	–.271
Dyad Disconnection	.614***	.145	Mixed	.245
			Positive	.274
			Positive Non	–.238
Dyad Ruination	.348*	.063	Neutral Ambivalent	–.251
Dyad Negotiation	.652***	.080	Conflicting	–.221
			Positive Ambivalent	.242
Dyad Impasse	.236+		None	–.236
Dyad Destruction	.384*		None	.291

*p < .05 **p < .01 ***p < .001
+*p* < .10

As can be seen, the FAR variables accounted for a significant and substantial amount of the variance in many of the behavioral outcomes. For example, it accounted for 32.9% of the total variance of Yellow-Yellow plays, 27.6% of the Total # of Trials, 29.6% of Total Dyad Dollar Payoffs, 29.3% of Dyad Collaboration, 22.9% of Dyad Distrust, 20.6% of Dyad Negotiation, and 18.8% of Dyad Destruction.

The ratio of the relatively large number of predictors to the relatively small sample sizes (because these were dyad-level data) renders interpretation of a large number of predictors unreliable. Thus we focus on the interpretation of the FAR variable associated with the largest standardized coefficient (β) in the final set of predictors. This analysis identified Neutral Reciprocation as one of the most important FAR variables associated with the behavioral outcomes. Neutral Reciprocity was positively correlated with Yellow-Yellow plays, Total # of Trials, Total Dyad Dollar Payoffs, Dyad Collaboration, Dyad Distrust, and Dyad Sociable, and negatively correlated with Dyad Ruination and Dyad Destruction. Neutral Reciprocation was coded when both players showed no emotions in a specified time window of play. These findings indicated, therefore, that reciprocal neutrality was in general associated with more positive behavioral outcomes.

Findings, Intercultural Condition (Task 2). We conducted the same analyses and interpreted the final findings in the same manner for the Intercultural Condition (Table 8). A very consistent picture emerged as with the Control Condition for the behavioral outcomes. The FAR variables accounted for a significant and substantial portion of the variance of the behavioral outcomes above and beyond the individual players' frequencies of the various facial expressions. Moreover, Neutral Reciprocity was positively correlated with Yellow-Yellow plays, Total # of Trials, and Total Dyad Dollar Payoffs, and negatively correlated with Blue-Blue plays. Thus once again Neutral Reciprocation was in general associated with more positive behavioral outcomes. Interestingly, different FAR variables were associated with the dyad play characterizations.

Table 8

Results of Hierarchical Multiple Regressions, Task 2

Total Facial Affect Reciprocity Scores				
Behavioral Outcomes	Final *R*	R^2_{chg}	Significant Facial Affect Reciprocity Variables	Beta
Yellow-Yellow Plays	.852***	.407	Negative Ambivalent	–.301
			Positive	.317
			Neutral	.449
			Neutral Ambivalent	.267
			Negative	.264
			Positive Ambivalent	.299
			Neutral Non	.229
Yellow-Blue Plays	.798***	.099	Conflicting	.249
			Positive Non	.264
Blue-Yellow Plays	.515**	.240	Negative Ambivalent	.455
			Neutral	.362
Blue-Blue Plays	.773***	.256	Neutral	–.442
			Neutral Non	–.420
			Positive Ambivalent	–.356
Total # Trials	1.000***	.407	Neutral	.731
			Positive Non	.385
			Neutral Ambivalent	.241
			Conflicting	.169
			Neutral Non	.502
			Positive	.369
			Negative	.347
			Negative Ambivalent	.161
			Positive Ambivalent	.266
			Mixed	.175
Total Dyad Dollar Payoff	.763***	.245	Neutral	.324
			Positive Ambivalent	.370
			Negative Ambivalent	–.238
Dyad Collaboration	.718***	.155	Negative Ambivalent	–.355
			Positive	.255
Dyad Distrust	.829***	.279	Neutral Non	.432
			Negative	–.560
			Conflicting	.270
			Neutral	.189
Dyad Standoff	.621***	.300	Neutral Ambivalent	.425
			Positive Ambivalent	–.304

Table 8 (continued)

			Mixed	.516
			Negative Ambivalent	–.312
Dyad Sociable	.874***	.369	Neutral Non	.673
			Negative	–.329
			Conflicting	.395
			Neutral	.383
			Mixed	.289
			Positive	.209
Dyad Dysfunctional	.673***		None	.709
Dyad Disconnection	.763***	.282	Neutral	.421
			Conflicting	.279
			Positive Non	.250
			Mixed	.228
Dyad Ruination	.401**		None	–.401
Dyad Negotiation	.278+		None	.278
Dyad Impasse	.422*	.092	Mixed	.311
Dyad Destruction	.689***	.173	Positive Non	–.461
			Neutral Non	–.290
Facial Affect Reciprocity Scores During Play Only				
Yellow-Yellow Plays	.872***	.442	Neutral	.457
			Neutral Ambivalent	.353
			Negative	.350
			Positive Non	.233
			Positive Ambivalent	.389
			Negative Ambivalent	–.251
			Neutral Non	.198
Yellow-Blue Plays	.768***	.053	Conflicting	.257
Blue-Yellow Plays	.437*	.115	Negative Ambivalent	.390
Blue-Blue Plays	.669***	.105	Neutral	–.338
Total # Trials	1.000	.407	Neutral	.651
			Conflicting	.213
			Neutral Ambivalent	.296
			Negative	.313
			Positive Non	.346
			Neutral Non	.386
			Negative Ambivalent	.273
			Positive Ambivalent	.219
Total Dyad Dollar Payoff	.798***	.299	Neutral	.360
			Positive Ambivalent	.430
			Positive Non	.277
			Neutral Non	.323

Table 8 (continued)

Dyad Collaboration	.752***	.206	Mixed	–.228
			Positive Ambivalent	.416
			Negative Ambivalent	–.361
Dyad Distrust	.825***	.272	Neutral Non	.213
			Negative	–.433
			Conflicting	.348
			Mixed	–.777
			Negative Ambivalent	.363
Dyad Standoff	.393**	.069	Positive Ambivalent	–.266
Dyad Sociable	.848***	.323	Neutral Non	.661
			Neutral	.410
			Conflicting	.308
			Negative Ambivalent	.290
			Positive	.199
Dyad Dysfunctional	.852***	.052	Mixed	.251
			Neutral Ambivalent	–.495
			Neutral Non	.335
			Negative	–.327
			Negative Ambivalent	.237
Dyad Disconnection	.813***	.361	Neutral	.487
			Conflicting	.212
			Positive Non	.348
			Negative Ambivalent	.375
			Positive	–.261
Dyad Ruination	.401***	.161	None	–.401
Dyad Negotiation	.615***	.302	Positive Non	.658
			Negative Ambivalent	.359
			Neutral Ambivalent	.292
Dyad Impasse	.448***	.114	Mixed	.352
Dyad Destruction	.699***	.260	Positive Ambivalent	–.453
			Neutral	–.301
			Neutral Non	–.301
Facial Affect Reciprocity Scores During Reaction Only				
Yellow-Yellow Plays	.768***	.271	Neutral	.348
			Positive	.453
			Neutral Non	.306
Blue-Yellow Plays	0.275+		None	.275
Yellow-Blue Plays	.831***	.154	Positive Non	.321
			Conflicting	.349
			Positive Ambivalent	–.258

Table 8 (continued)

Blue-Blue Plays	.776***	.260	Neutral	–.393
			Neutral Non	–.457
			Positive Ambivalent	–.301
			Positive Non	–.230
Total # Trials	1.000***	.222	Neutral	.639
			Positive Non	.351
			Positive	.521
			Neutral Non	.491
			Mixed	.168
			Conflicting	.119
			Neutral Ambivalent	.235
			Positive Ambivalent	.168
Total Dyad Dollar Payoff	.648***	.083	Negative Ambivalent	–.289
Dyad Collaboration	.682***	.106	Positive	.233
			Conflicting	–.235
Dyad Distrust	.766***	.178	Negative	–.614
			Neutral Non	.424
Dyad Standoff	.485***	.150	Neutral Ambivalent	.427
Dyad Sociable	.836***	.304	Conflicting	.348
			Neutral	.280
			Negative	–.470
			Neutral Non	.314
Dyad Dysfunctional	.712***	.100	Positive	–.372
Dyad Disconnection	.703***	.194	Conflicting	.339
			Neutral	.289
			Positive Non	.265
Dyad Ruination	.477***	.066	Negative	.310
Dyad Negotiation	.278+		None	.278
Dyad Impasse	.293+		None	–.293
Dyad Destruction	.674	.152	Positive Non	–.405
			Neutral Non	–.263

*$p < .05$ **$p < .01$ ***$p < .001$
+$p < .10$

Findings, Stress Condition (Task 3). We conducted the same analyses and interpreted the final findings in the same manner for the Stress Condition (Table 9). A very consistent picture emerged with the previous two conditions. The FAR variables accounted for a significant and substantial portion of the variance of the behavioral outcomes above and beyond the individual players' frequencies of the various facial expressions. Moreover, Neutral Reciprocation was positively correlated with Yellow-Yellow plays, Total # of Trials, Total Dyad Dollar Payoffs, Dyad Collaboration, Dyad Distrust, and Dyad Sociable, and negatively

correlated with Blue-Blue plays, Dyad Ruination, and Dyad Destruction. Thus, once again, reciprocal neutrality was in general associated with more positive behavioral outcomes.

Table 9

Results of Hierarchical Multiple Regressions, Task 3

Total Facial Affect Reciprocity Scores				
Behavioral Outcome	Final *R*	R^2_{chg}	Significant Facial Affect Reciprocity Variables	Beta
Yellow-Yellow Plays	.736***	.329	Neutral	.636
			Positive reciprocation	.451
Yellow-Blue Plays	.541**	.055	Neutral Non	.318
Blue-Yellow Plays	ns	ns	ns	ns
Blue-Blue Plays	.499**		Neutral	–.603
			Positive Ambivalent	–.364
Total # Trials	.680***	.276	Neutral	.728
			Positive Non	.449
			Neutral Non	.348
			Positive Ambivalent	.254
Total Dyad Dollar Payoff	.605 ***	.296	Neutral	.572
Dyad Collaboration	.747***	.293	Neutral	.751
			Positive Non	–.460
Dyad Distrust	.579***	.229	Neutral	.485
			Positive Non	.277
Dyad Standoff	.479**		None	.341
Dyad Sociable	.539**		Neutral	.586
			Positive Ambivalent	.438
			Neutral Non	.233
Dyad Dysfunctional	ns	ns	ns	ns
Dyad Disconnection	.476**		None	.318
Dyad Ruination	.258+		Neutral	–.258
Dyad Negotiation	.656***	.206	Neutral Non	.493
			Positive Non	.341
			Conflicting	–.294
Dyad Impasse	.485**		None	.396
Dyad Destruction	.549**	.188	Neutral	–.502
			Positive Ambivalent	–.409

Table 9 (continued)

Facial Affect Reciprocity Scores During Play Only				
Yellow-Yellow Plays	.695***	.271	Neutral	.557
			Positive Non	.404
			Neutral Non	.239
Yellow-Blue Plays	.487*		None	.263
Blue-Yellow Plays	ns		ns	ns
Table 9, cont.				
Blue-Blue Plays	0.498**	.248	Neutral	–.512
			Positive Non	–.379
			Neutral Non	–.268
Total # Trials	.879***	.598	Neutral	.832
			Positive Non	.569
			Neutral Non	.362
			Positive Ambivalent	.184
Total Dyad Dollar Payoff	.538***	.220	Neutral	.496
Dyad Collaboration	.656***	.165	Neutral	.514
Dyad Distrust	.573***	.221	Neutral	.474
			Positive Non	.343
Dyad Standoff	.479**		None	.341
Dyad Sociable	.448**	.201	Neutral	.435
			Mixed	.334
Dyad Dysfunctional	ns		ns	ns
Dyad Disconnection	.544**	.069	Neutral Ambivalent	–.282
Dyad Ruination	ns		ns	ns
Dyad Negotiation	.473***		None	.473
Dyad Impasse	.587**	.109	Neutral Non	–.300
			Positive	–.250
Dyad Destruction	.630***	.283	Neutral	–.518
			Positive Non	–.347
			Positive Ambivalent	–.261
Facial Affect Reciprocity Scores During Reaction Only				
Yellow-Yellow Plays	.771***	.383	Neutral	.713
			Positive	.498
Yellow-Blue Plays	.568**	.085	None	.111
Blue-Yellow Plays	.297*	.088	Positive Non	.297
Blue-Blue Plays	.542***	.294	Neutral	–.657
			Positive Ambivalent	–.387
Total # Trials	.865***	.574	Neutral	.747
			Positive	.304

Table 9 (continued)

			Positive Non	.337
			Neutral Non	.456
			Positive Ambivalent	.299
			Neutral Ambivalent	.169
Total Dyad Dollar Payoff	.677***	.389	Neutral	.729
			Positive	.293
Dyad Collaboration	.705***	.233	Neutral	.645
Dyad Distrust	.538***	.183	Reaction Neutral	.428
Dyad Standoff	.479**		None	.341
Dyad Sociable	.520**	.270	Reaction Neutral	.629
			Reaction Positive Ambivalent	.397
Dyad Dysfunctional	ns		ns	ns
Dyad Disconnection	.535**	.059	Negative Ambivalent	.266
Dyad Ruination	.413*	.171	Neutral	–.479
			Positive	–.313
Dyad Negotiation	.623***	.164	Neutral Non	.512
			Neutral	–.258
Dyad Impasse	.600***	.125	Negative Ambivalent	–.311
			Neutral	–.325
Dyad Destruction	.337*		None	–.337

*$p < .05$ **$p < .01$ ***$p < .001$
+$p < .10$

Summary. The findings indicated that the FAR variables predicted the behavioral outcomes of the dyads above and beyond what could be predicted by the individual facial expression variables, as predicted. Surprisingly, however, it was not the exchange of *emotional expressions* per se that was the best predictor of the various outcomes; instead it was the exchange of *no emotions* or neutrality that was the best predictor. Neutral Reciprocation was associated with greater cooperation, less competitiveness, and better outcomes (in terms of dollar payoffs) in all three studies. This finding is especially interesting given the fact that the participants were clearly emotional (as evidenced by their self-reported emotional experiences), and showed a variety of emotional expressions, both positive and negative, throughout the game play. These findings suggest a strong potential role for *expression regulation* in dyadic interchange, which we will discuss more fully below.

Post-Hoc Analyses

Synchrony in self-reported emotions predicting outcomes. We created synchrony scores between the two players' self-reported emotions by computing Pearson correlations between their self-reported emotional experience ratings across the 12 scales, separately for pre- and posttests. We then computed a Time (pre vs. post) x Condition (3) mixed factor ANOVA on these synchrony scores. The two-way interaction was significant, $F(2, 130) = 5.999$, $p < .01$, $\eta_p^2 = .084$. Simple effects analyses of Time indicated that there were no changes in synchrony for

the Control or Intercultural Conditions, $F(1, 47) = 0.12$, ns; and $F(1, 39) = 0.26$, ns, respectively. But the synchrony in emotional experience between the two players significantly decreased in the Stress Condition, $F(1, 44) = 15.10$, $p < .001$, $\eta_p^2 = .26$.

To examine whether the synchrony in self-reported emotional experiences between the players was reliably associated with the behavioral outcomes, we correlated the synchrony scores with the dyad play characterizations, separately for each Condition and Time. Interestingly, posttest synchrony in emotional experience was positively correlated with Total # of Trials, Total Dyad Dollar Payoff, Dyad Collaboration, and Total Prosocial Acts, and negatively correlated with Dyad Ruination, Dyad Impasse, Dyad Destruction, and Total Antisocial Acts, but only for the Control Condition. No other Conditions or Times produced a reliable pattern of results (Table 10).

Table 10

Correlations Between Synchrony in Self-Reported Emotions and Behavioral Outcomes

	Task 1 (Control)		Task 2 (Intercultural)		Task 3 (Stress)	
Behavioral Outcome	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Total # Trials	.100	.375**	–.190	.002	.064	–.127
Total Dyad Dollar Payoff	–.038	.394**	–.218	.123	.114	–.156
Total Dyad Collaboration	–.137	.295*	–.282*	.172	.11	.114
Total Dyad Distrust	.164	.039	.126	.024	.016	–.222
Total Dyad Standoff	.107	.055	–.194	–.134	.061	.129
Total Dyad Sociable	.266*	.074	.066	–.026	.097	–.116
Total Dyad Dysfunctional	.037	–.074	.119	–.101	.021	–.154
Total Dyad Disconnection	.176	–.004	–.041	–.271	–.072	–.042
Total Dyad Ruination	–.036	–.505***	.292*	.106	–.21	.101
Total Dyad Negotiation	.031	–.058	.214	.164	–.09	–.015
Total Dyad Impasse	.078	–.364**	–.057	–.179	–.108	.23
Total Dyad Destruction	–.047	–.327*	.102	–.092	.091	.07
Total Prosocial Acts	–.02	.406**	–.234	.101	.11	–.139
Total Antisocial Acts	.114	–.295*	.165	–.221	–.088	.042

*p < .05 **p < .01 ***p < .001

Relationships between Geographic and Cultural Distance with behavioral outcomes. We computed correlations between the Geographic and Cultural Distance scores with each of the behavioral outcomes in the Intercultural Condition (as these analyses were dyad-level, we summed the two players' behavioral outcome scores for each dyad). Interestingly, greater cultural distances on Power Distance were negatively associated with Total Yellow plays, Total Dollar Payoffs, Total Cooperation, and Total Prosocial Acts, and positively associated with Total Blue plays, Total Defection, Total Reconciliation, and Total Antisocial Acts. Thus greater cultural distance on Power Distance was reliably associated with less positive behavioral outcomes. Geographic Distance was not significantly correlated with any behavioral outcome (Table 11).

To examine and control for the possible contribution of differences in personality to the behavioral outcomes in Task 2, we computed one-way ANOVAs on the five personality trait scores using Condition as the independent variable. Only Openness produced a significant difference among conditions, $F(2, 289) = 3.337$, $p < .05$, $\eta_p^2 = .02$, and post-hoc least significant difference (LSD) analyses indicated that the Intercultural Condition produced significantly lower Openness scores than the other two conditions (ps < .05). To examine this effect further we computed one-way ANOVAs on the personality traits in the Intercultural Condition only, between U.S.-born-and-raised Americans and International Students. Again Openness was the only trait to produce a significant effect, $F(1, 80) = 18.51$, $p < .001$, $\eta_p^2 = .19$; Americans (M = 33.76, SD = 6.13) had significantly higher scores on Openness than did the International Students (M = 28.10, SD = 5.78).

We thus computed a difference score on Openness between the players in the Intercultural Condition, and correlated it with the same behavioral outcome variables used with the Cultural Distance scores. Interestingly, differences in Openness were negatively correlated with Total Yellow Plays, Total Trials, Total Dollar Payoffs, Total Cooperation, and Total Prosocial Acts (Table 11).

Table 11

Correlations Between Cultural Distance, Geographic Distance, Difference in Openness and Behavioral Outcomes, Intercultural Condition Only

	Cultural Distance on						
Behavioral Outcome	Individualism vs. Collectivism	Power Distance	Uncertainty Avoidance	Masculinity vs. Femininity	Long vs. Short Term Orientation	Geographic Distance	Difference in Openness
Total Yellow Plays	.030	–.291*	.182	.150	.232	–.176	–.378*
Total Blue Plays	.075	.337*	.107	.092	–.267	.036	.200
Total Trials	.078	–.167	.284*	.236	.147	–.196	–.352*
Total Dyad Payoff	.022	–.319*	.107	.083	.289	–.172	–.334*
Total Cooperation	–.054	–.343*	.088	.038	.291	–.111	–.316*
Total Betrayal	.106	.045	.030	.205	–.342*	–.017	–.182
Total Forgiveness	.218	.217	.109	.064	–.072	–.290	–.100
Total Retaliation	.011	.141	.261	.208	–.040	.119	.106
Total Reparation	.110	–.006	.213	.251	–.137	–.001	–.146
Total Defection	.112	.418**	.074	–.099	.147	–.226	.231
Total Reconciliation	–.005	.285*	.056	.181	–.156	.047	.167
Total Stalemate	–.029	.155	–.100	–.062	–.262	.148	.251
Total Prosocial Acts	.026	–.289*	.187	.147	.232	–.178	–.379*
Total Antisocial Acts	.088	.328*	.114	.112	-.259	.029	.183

*$p < .05$ **$p < .01$

To examine whether Cultural Distance was associated with the behavioral outcomes even when differences in personality between the players were accounted for, we computed simultaneous multiple regressions on selected behavioral outcomes, using both Cultural Distance scores on Power Distance and difference in Openness scores as predictors. The Cultural Distance scores were still significantly associated with Total Blue Plays, Total Trials, Total Dyad Dollar Payoffs, and Total Antisocial Acts, and were marginally significant with Total Yellow Plays and Total Prosocial Acts (Table 12).

Table 12

Results of Multiple Regressions: Cultural Differences on Power Distance Predicting Behavioral Outcomes Controlling for Differences in Openness, Intercultural Condition

Behavioral Outcome	Final *R*	$\beta_{\text{Difference in Openness}}$	$\beta_{\text{Difference in PD}}$
Total Yellow Plays	.456*	.355*	–.246+
Total Blue Plays	.382+	0.180	.314*
Total Trials	.456*	–.328*	–.278*
Total Dollar Payoffs	.373+	–0.125	–.336*
Total Prosocial Acts	.457*	–.356*	–.244+
Total Antisocial Acts	.367+	0.166	.307*

*$p < .05$
+$p < .10$

Discussion

The results produced interesting findings concerning the potential role of FAR and its relationship to behavioral outcomes in dyadic interactions involving games of cooperation and competition. Post-hoc analyses also produced unexpected findings concerning the relationship between synchrony in emotional experience between the interactants and the behavioral outcomes of the play, as well as interesting cultural differences in Task 2 (the Intercultural Condition).

These results were not produced without limitations, perhaps the biggest of which concerned the game instructions. In particular, players were instructed not to talk with each other during the game play. This simple instruction may have served to enhance the role of nonverbal behaviors such as facial expressions in ways that do not mirror what happens when interactants can dialogue with each other. Also, the inability to talk made the situation somewhat unnatural—participants interacted with strangers whom they had never met before, and certainly behavioral outcomes will differ according to different interactant relationships that vary on familiarity, intimacy, status, and future interactions. It is very possible that different instructions and

conditions of game play may produce different results, and readers are cautioned in interpret the results produced with this caveat.

Another limitation has to do with the nature of the self-reported emotion variables. Self-reports can be unreliable, and when obtained at the times they were, it is not exactly clear to what they refer. The pre to post changes in emotion, for example, may certainly reflect gross emotional changes due to the plays of the game; but they may also reflect emotional changes due to the fact that the game had ended, or reactions to the other player or experimenter, and not necessarily the game play. Also, emotions assessed in the manner we chose cannot reflect the transient, moment-to-moment emotional reactions that are likely to have occurred throughout game play. Thus, the findings with regard to the self-reported emotional experience should be interpreted with this caveat.

We discuss below the findings with respect to the main analyses involving FAR, and then the two post-hoc analyses producing findings on synchrony of self-reported emotions and cultural differences.

Facial Affect Reciprocity

In general, the findings indicated relationships between behavioral outcomes and a wide variety of different types of FAR variables. Certainly some of these findings may be due to the relatively large variable-to-case ratio, which would tend to make some of the findings associated with the later steps of the hierarchical regressions unreliable. One of the most consistent findings throughout all analyses and all three studies, however, concerned Neutral Reciprocation. As described earlier, Neutral Reciprocation referred to the case when both players displayed no emotion on their faces. Neutral Reciprocation was generally associated with more cooperative plays, less competitive plays, longer play periods, and greater dollar payoffs for the dyad, across all three studies, and separately for analyses isolating play periods, reaction periods, and overall. This variable emerged relatively early in the hierarchical regressions, and thus was relatively less influenced by the unreliability of the findings due to the high variable-to-case ratio. These findings were not confounded by a lack of emotional responding, as the self-report data showed that participants indeed changed their emotional experiences as a function of game play; and participants produced a sufficient amount of facial expressions of emotion. Also, descriptive statistics on the FAR variables showed that these also had sufficient range for the regression analyses.

It was surprising that Neutral Reciprocation was found to be such a reliable predictor of the behavioral outcomes across conditions. We had originally hypothesized that Positive, Negative, and Mixed Reciprocation would be related to the outcomes. While these variables were indeed significantly correlated with many of the dependent variables, they did not match the consistency of Neutral Reciprocity in the findings.

There are several potential reasons why the exchange of neutral expressions would predict better outcomes. First of all, these findings suggest a role for the concept of emotion regulation in predicting behavioral outcomes. Emotion regulation refers to the degree to which individuals can manage and modify their emotional reactions in order to achieve constructive,

goal-directed outcomes (Gross, 1999; Gross & John, 2003). One component of emotion regulation is expression regulation—the management and modification of emotional expressions (Gross & John, 2003; Matsumoto, Yoo, et al., 2008). Expressing neutrality despite the fact that one is obviously emotional (as evidenced by the self-report data) might reflect some degree of emotion regulation, and both players' engagement in emotion regulation may reflect attempts by both players to not allow their emotional reactions to get the better of them as they made decisions concerning game play, thus allowing for more cooperative plays and better outcomes.

Another (non-mutually exclusive) interpretation concerning Neutral Reciprocation may be related to the interpersonal functions of the emotional expressions. Previous research has shown that facial expressions of emotion facilitate specific behaviors in perceivers (Marsh et al., 2005; Winkielman et al., 2005), and that emotional displays evoke specific, complementary emotional responses from observers (Dimberg & Ohman, 1996; Eisenberg et al., 1989; Esteves et al., 1994). Facial expressions of emotion serve as signs of the nature of interpersonal relationships (Gottman & Levenson, 1992; Gottman et al., 2001), and as regulators of social interaction (Bradshaw, 1986; Campos et al., 2003; Hertenstein & Campos, 2004; Klinnert et al., 1983; Sorce et al., 1985). If participants were emotional and displayed their emotions in their expressions, this would have been a potential source for interpretations of the other player's reactions to previous plays and intentions in future plays. But despite this emotionality, it may have been the case that the mutual reciprocation of neutrality served to demonstrate to the other player that one's emotions were not getting the better of oneself, thus allowing for more rational decision making that led to cooperative play. This interpretation is bolstered especially by the fact that Neutral Reciprocation was more of a unique predictor of positive behavioral outcomes in Task 3 (Stress Condition), even though the players were very emotional and behavioral outcomes were worse than in Task 1 (the Control Condition).

There may be other interpretations of the findings, and the ones provided here are speculative and require further testing. One limitation to the second interpretation above has to do with the fact that we had no data (e.g., eye-tracking) to know definitively that the interactants saw the other's expressions precisely at the time they were expressive (or not, in the case of Neutral Reciprocity). Such data would be important to obtain in future research to support any interpretations concerning the potential interpersonal effects of expressions on the game play.

These findings have potentially interesting implications for practice. As mentioned in the Introduction, effective team performance is vital for all branches of the military at all levels. Findings implicating the importance of expression regulation in team operations suggests that one of the best ways to ensure efficient teamwork and positive behavioral outcomes is to regulate one's emotional displays (and most likely emotional experiences) so that one can engage in rational decision-making processes that maximize the possibility of obtaining one's goals and objectives, as well as those of one's team. Team members who see that others are engaging in emotion and expression regulation can rely on the idea that others' behaviors will not be governed by irrational emotional processes and can thus likely reciprocate behaviorally as well as emotionally. This leads to the interesting speculation that instructing team members to regulate their expressions may actually enhance team outcomes, a hypothesis that can be tested in the future.

Synchrony in Self-Reported Emotional Experience

Another interesting and unexpected finding concerned the relationship between the synchrony in self-reported emotional experience and the behavioral outcomes. Greater synchrony was associated with more positive outcomes after the experiment, but only in Task 1 (the Control Condition). It was interesting that synchrony was not related to the outcomes at pretest in the same investigation, nor for pretests or posttests for any of the other studies. To be sure, because the posttest occurred after the game play, it is difficult if not impossible to interpret that the synchrony in emotional experience caused the performance; rather, it is more likely that the more cooperative performances in the non-stress Control Condition of Task 1 produced similar emotional reactions in both interactants.

These findings raise interesting questions concerning the possibility of synchronicity variables being markers of performance or the nature of the relationships in dyadic interactions. Increased synchrony may be a sign of the degree of harmony or cohesion of a dyad. But the fact that synchrony was correlated with performance only in the Control Condition (Task 1) and not in the Intercultural or Stress Conditions (Tasks 2 or 3) suggests that synchrony may occur only with positive outcomes. Indeed an argument could be made that increased synchrony (of negative emotions) is positively associated with more destructive outcomes, in which case one would predict a positive relationship between synchrony and negative outcomes in Task 3. That this did not occur suggests that synchrony may occur only after relatively greater cooperative play and positive outcomes. Because these findings were new and unexpected, they need to be replicated in future work.

Intercultural Differences in Outcomes

Another interesting post-hoc finding was that the Intercultural Condition produced less cooperation and more competition than the Control Condition, at comparable levels to the Stress Condition, even though the instructions and procedures were the same as the Control Condition. Within the Intercultural Condition there were no differences in the behaviors between the Americans and International Students or across the plays. Greater cultural differences, as defined by the difference in home country Hofstede scores on Power Distance, were associated with less cooperation and more competition, and these relationships existed above and beyond differences in personality traits between the players. Finally, there were interesting differences in self-reported emotions, with International Students experiencing more happiness and pride and less guilt than the Americans at the end of the play.

These analyses were not conducted without limitations, the first of which concerned the nature of the Cultural Distance scores computed. Difference scores of participants' external, home country scores on cultural dimensions are fairly abstract and diffuse, and not strongly linked to the participants. On the one hand, they offer the advantage of not being tied to individual-level measurements that may be confounded by personality, and to some extent offer an acceptable Type II error if non-findings exist. On the other hand, it is not clear as to what the differences specifically refer to, thus rendering definitive conclusions problematic. For example, it is unclear whether the differences refer to differences in attitudes, values, beliefs, norms, or

even some implicitly held cognitions or behavioral patterns. Certainly other methods of creating cultural difference measures exist and should be explored in the future.

Given this and other limitations, however, it is interesting to speculate about the nature of the cultural differences that were associated with the behavioral outcomes. It is surprising that differences on Individualism vs. Collectivism were *not* associated with the outcomes, given that individualism is often linked with competition and collectivism with cooperation (Triandis, 1995). Yet perhaps it makes sense that this dimension not be very salient in our experiment, given that Individualism vs. Collectivism is primarily about the nature of self-ingroup relationships, and all participants in our investigation were strangers in an unfamiliar setting. Given this context, it may have been the case that cultural frameworks related to power, status, and hierarchy were more salient. Relatively smaller differences between the participants on Power Distance would reflect a more egalitarian framework for both participants, relegating each other more as equals and thus producing more cooperative behaviors. Relatively greater differences between the participants on Power Distance, however, may have reflected a more hierarchical, status, or power driven framework for the participants (or at least for one of them), which may have facilitated more competitive behaviors in order to establish or clarify the hierarchical relationship between the two. Indeed, this is what we found: smaller differences on Power Distance were associated with more cooperation and less competition, while greater differences on Power Distance were associated with less cooperation and more competition. Of course this interpretation is speculative, and future research will need to address whether these status and power-related frameworks were indeed salient in the participants, and whether such power dynamics are actually at work in these situations.

The results of the self-reported emotions lend some credence to this interpretation. If status and power dynamics are at work in the Intercultural Condition, then it may make sense that Americans increased in contempt at the end of the play while the International Students did not. Contempt is an emotion about hierarchy and status differences, and American students may have felt relatively more contempt because of a (perhaps unconscious) tension concerning power and status. The International Students, however, increased in happiness and pride, and decreased in guilt. It is possible that the International Students had these positive emotional reactions in relation to the same tension related to power and status. These speculative interpretations are bolstered by the fact that on average the International Students ended up with slightly more money payoffs than did the Americans (albeit a non-significant difference).

Although not predicted, we also found that differences in player's levels of Openness were associated with some of the behavioral outcomes. This finding also bolsters the interpretation above concerning cultural differences fueling the behavioral outcomes we observed, as Openness would reflect the degree to which individuals were receptive to engaging with differences. It was equally interesting that differences on the other personality traits were not related to the outcomes. This finding should be pursued in future studies, especially examining the effects of personality by culture-difference interactions on cooperative behavior.

These post-hoc findings have important implications for future empirical work. As discussed in the Introduction, this investigation adds to a growing literature examining behavioral outcomes of intercultural interactions in cooperative tasks, demonstrating that these

interactions can be costly. The present findings should spur the search for more precise cultural ingredients that drive these costly differences. Future studies involving differences in attitudes, values, beliefs, goals, and especially norms should be fruitful in uncovering the active cultural ingredients that drive the differences observed.

These findings also have important ramifications for practitioners. Knowing that intercultural interactions are difficult and potentially costly is important for many to recognize. Identifying the specific source of the differences can help practitioners to target those variables to avoid unnecessary conflict and to facilitate cooperation and harmony in intercultural interactions. This should be true in health-care interactions, negotiations, and business settings alike. Much teamwork in the U.S. military involves intercultural, multi-national teams. Our findings suggest that such teams may be predisposed to work *less* efficiently and cooperatively, just from the fact that they are comprised of people from different cultural backgrounds. And this predisposition may be larger the greater the cultural distance among the members of the teams. Thus, individuals who work in intercultural teams may take active steps to minimize the potentially disruptive influence of the intercultural composition on teamwork, including discussing ground rules for interaction, being clear not only on goals and objectives but also on process.

References

Anstadt, T., Merten, J., Ullrich, B., & Krause, R. (1997). Affective Dyadic Behavior, Core Conflictual Relationship Themes, and Success of Treatment. *Psychotherapy Research, 7,* 397–417.

Ashkanasy, N. M., & Daus, C. S. (2005). Rumors of the death of emotional intelligence in organizational behavior are vastly exaggerated. *Journal of Organizational Behavior, 26,* 441–452.

Barsade, S. G., Ward, A. J., Turner, J. D. F., & Sonnenfeld, J. A. (2000). To your heart's content: A model of affective diversity in top management teams. *Administrative Science Quarterly, 45,* 802–836.

Berenbaum, H., & Oltmanns, T. (1992). Emotional experience and expression in schizophrenia and depression. *Journal of Abnormal Psychology, 101,* 37–44.

Bradshaw, D. (1986). *Immediate and prolonged effectiveness of negative emotion expressions in inhibiting infants' actions* (Unpublished doctoral dissertation). University of California, Berkeley.

Buck, R. W. (1976). A test of nonverbal receiving ability: Preliminary studies. *Human Communication Research, 2,* 162–171.

Buck, R. W. (1977). Nonverbal communication of affect in preschool children: Relationships with personality and skin conductance. *Journal of Personality and Social Psychology, 35,* 225–236.

Cacioppo, J. T., Berntson, G. G., Larsen, J. T., Poehlman, K. M., & Ito, T. A. (2000). The psychophysiology of emotion. In R. Lewis & J. M. Haviland-Jones (Eds.), *The handbook of emotion* (2nd ed., pp. 173–191). New York, NY: Guilford.

Campos, J., Thein, S., & Owen, D. (2003). A Darwinian legacy to understanding human infancy: Emotional expressions as behavior regulators. In P. Ekman, J. Campos, R. J. Davidson & F. B. M. De Waal (Eds.), *Emotions inside out: 130 years after Darwin's "The expression of the emotions in man and animals"* (Vol. 1000, pp. 110–134). New York, NY: New York Academy of Sciences.

Camras, L. A., Holland, E. A., & Patterson, M. J. (1993). Facial expression. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 199–208). New York, NY: Guilford Press.

Camras, L. A., Oster, H., Campos, J. J., & Bakeman, R. (2003). Emotional facial expressions in European-American, Japanese, and Chinese infants. In P. Ekman, J. J. Campos, R. J. Davidson & F. B. M. De Waal (Eds.), *Emotions inside out: 130 years after Darwin's "The expression of the emotions in man and animals"* (Vol. 1000, pp. 135–151). New York, NY: New York Academy of Sciences.

Carr, L., Iacobini, M., Dubeau, M. C., Mazziota, J. C., & Lenzi, G. L. (2003). Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas. *Proceedings of the National Academy of Sciences, 100,* 5497–5502.

Carstensen, L. L., Gottman, J. M., & Levenson, R. W. (1995). Emotional behavior in long-term marriage. *Psychology & Aging, 10,* 140–149.

Casey, R. J. (1993). Children's emotional experience: Relations among expression, self-report, and understanding. *Developmental Psychology, 29*, 119–129.

Charlesworth, W. R. (1970). *Surprise reactions in congenitally blind and sighted children.* Washington, DC: National Institute of Mental Health Progress Report.

Chesney, M. A., Ekman, P., Friesen, W. V., Black, G. W., & Hecker, M. (1990). Type A behavior pattern: Facial behavior and speech components. *Psychosomatic Medicine, 52,* 307–319.

Chevalier-Skolnikoff, S. (1973). Facial expression of emotion in nonhuman primates. In P. Ekman (Ed.), *Darwin and facial expression* (pp. 11–89). New York, NY: Academic Press.

Cole, P. M., Jenkins, P. A., & Shott, C. T. (1989). Spontaneous expressive control in blind and sighted children. *Child Development, 60*(3), 683–688.

Cook, W. L., Strachan, A. M., Goldstein, M. J., & Miklowitz, D. J. (1989). Expressed emotion and reciprocal affective relationships in families of disturbed adolescents. *Family Process*, *28*(3), 337–348.

Costa, P. T., & McCrae, R. R. (1989). *The Neo-PI/Neo-FFI manual supplement*. Odessa, FL: Psychological Assessment Resources.

Costa, P. T., & McCrae, R. R. (1992). *Revised Neo-Personality Inventory (NEO-PI-R) and Neo Five Factor Inventory (NEO-FFI)*. Odessa, FL: Psychological Assessment Resources.

Darwin, C. (1872). *The expression of emotion in man and animals*. New York, NY: Oxford University Press.

Daus, C. S., & Ashkanasy, N. M. (2005). The case for the ability-based model of emotional intelligence in organizational behavior. *Journal of Organizational Behavior*, *26*, 453–466.

Davidson, R. J., Ekman, P., Saron, C. D., Senulis, J. A., & Friesen, W. (1990). Approach-withdrawal and cerebral asymmetry: Emotional expression and brain physiology: I. *Journal of Personality & Social Psychology*, *58*, 330–341.

De Waal, F. B. M. (2002). Apes from Venus: Bonobos and human social evolution. In F. B. M. De Waal (Ed.), *Tree of origin: What primate behavior can tell us about human social evolution* (pp. 39–68). Cambridge, MA: Harvard University Press.

Dimberg, U., & Ohman, A. (1996). Behold the wrath: Psychophysiological responses to facial stimuli. *Motivation & Emotion, 20,* 149–182.

Duchenne de Boulogne, G. B. (1862/1990). *The mechanism of human facial expression*. New York, NY: Cambridge University Press.

Eibl-Eibesfeldt, I. (1973). The expressive behavior of the deaf-and-blind born. In M. von Cranach & I. Vine (Eds.), *Social communication and movement* (pp. 163–194). London, England: Academic Press.

Eibl-Eibesfeldt, I. (1989). *Human ethology*. New York, NY: Aldine de Gruyter Press.

Eisenberg, N., Fabes, R. A., Miller, P. A., Fultz, J., Shell, R., Mathy, R. M., & Reno, R. R. (1989). Relation of sympathy and distress to prosocial behavior: A multimethod study. *Journal of Personality and Social Psychology, 57,* 55–66.

Ekman, P. (1972). Universal and cultural differences in facial expression of emotion. In J. R. Cole (Ed.), *Nebraska Symposium on Motivation, 1971* (Vol. 19, pp. 207–283). Lincoln: Nebraska University Press.

Ekman, P. (1989). Why lies fail and what behaviors betray a lie. In John C. Yuille (Ed.), *Credibility assessment. NATO Advanced Science Institutes series. Series D: Behavioural and social sciences, Vol 47.* (pp. 71–81). Dordrecht, Netherlands: Kluwer Academic Publishers.

Ekman, P. (1992a). Are there basic emotions? *Psychological Review, 99,* 550–553.

Ekman, P. (1992b). An argument for basic emotions. *Cognition & Emotion, 6,* 169–200.

Ekman, P. (1992c). Facial expressions of emotion: New findings, new questions. *Psychological Science, 3,* 34–38.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48*(4), 384–392.

Ekman, P. (1999). Basic emotions. In T. Dalgleish & T. Power (Eds.), *The handbook of cognition and emotion* (pp. 45–60). Sussex, United Kingdom: John Wiley and Sons, Ltd.

Ekman, P. (2003). *Emotions revealed* (2nd ed.). New York, NY: Times Books.

Ekman, P., Davidson, R. J., & Friesen, W. V. (1990). The Duchenne smile: Emotional expression and brain physiology: II. *Journal of Personality & Social Psychology, 58,* 342–353.

Ekman, P., & Friesen, W. V. (1971). Constants across culture in the face and emotion. *Journal of Personality and Social Psychology, 17*, 124–129.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues*. Englewood Cliffs, NJ: Prentice-Hall.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: Investigator's guide*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., & Friesen, W. V. (1982). *EMFACS*. San Francisco, CA.

Ekman, P., Friesen, W. V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology, 39*, 1125–1134.

Ekman, P., Friesen, W. V., & Ellsworth, P. (1972). *Emotion in the human face: Guidelines for research and an integration of findings*. New York, NY: Pergamon Press.

Ekman, P., Friesen, W. V., & O'Sullivan, M. (1988). Smiles when lying. *Journal of Personality & Social Psychology, 54*, 414–420.

Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science, 221*(4616), 1208–1210.

Ekman, P., Matsumoto, D., & Friesen, W. (1997). Facial expression in affective disorders. In P. Ekman & E. L. Rosenberg (Eds.), *What the face reveals: Basic and applied studies of spontaneous expression using the Facial Action Coding System (FACS)* (pp. 331–341). New York, NY: Oxford University Press.

Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual Review of Psychology, 30*, 527–554.

Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist, 46*, 913–920.

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pancultural elements in facial displays of emotion. *Science, 164*(3875), 86–88.

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128*, 205–235.

Esteves, F., Dimberg, U., & Ohman, A. (1994). Automatically elicited fear: Conditioned skin conductance responses to masked facial expressions. *Cognition and Emotion, 8*, 393–413.

Fleishman, E. A., Quaintance, M. K. (1984). *Taxonomies of human performance: The description of human tasks.* Orlando, FL: Academic Press.

Fleishman, E. A., & Zacarro, S. J. (1992). Toward a taxonomy of team performance functions. In R. J. Swezey & E. Salas (Eds.), *Teams: Their training and performance*. Orlando, FL: Academic Press.

Frank, M. G., Ekman, P., & Friesen, W. V. (1993). Behavioral markers and recognizability of the smile of enjoyment. *Journal of Personality & Social Psychology, 64,* 83–93.

Frank, R. H. (1988). *Passions without reason*. New York, NY: Norton.

Freedman, D. G. (1964). Smiling in blind infants and the issue of innate versus acquired. *Journal of Child Psychology and Psychiatry, 5*, 171–184.

Fridlund, A. (1994). *Human facial expression: An evolutionary view*. San Diego, CA: Academic Press.

Galati, D., Miceli, R., & Sini, B. (2001). Judging and coding facial expression of emotions in congenitally blind children. *International Journal of Behavioral Development, 25*, 268–278.

Galati, D., Sini, B., Schmidt, S., & Tinti, C. (2003). Spontaneous facial expressions in congenitally blind and sighted children aged 8-11. *Journal of Visual Impairment & Blindness, 97*, 418–428.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119,* 593–609.

Geen, T. (1992). Facial expressions in socially isolated nonhuman primates: Open and closed programs for expressive behavior. *Journal of Research in Personality, 26*, 273–280.

Gonzaga, G. C., Keltner, D., & Londahl, E. A. (2001). Love and the commitment problem in romantic relationships and friendship. *Journal of Personality and Social Psychology, 81*, 247–262.

Goodenough, F. L. (1932). Expression of emotions in a blind-deaf child. *Journal of Abnormal and Social Psychology, 27*, 328–333.

Gosselin, P., Kirouac, G., & Dore, F. (1995). Components and recognition of facial expression in the communication of emotion by actors. *Journal of Personality and Social Psychology, 68*, 83–96.

Gottman, J. M., Coan, J. A., Carrere, S., & Swanson, C. (1998). Predicting Marital Happiness and Stability from Newlywed Interactions. *Journal of Marriage and the Family, 60*, 5–22.

Gottman, J. M., & Levenson, R. W. (1992). Marital processes predictive of later dissolution: Behavior, physiology, and health. *Journal of Personality and Social Psychology, 63*, 221–223.

Gottman, J. M., & Levenson, R. W. (2002). A two-factor model for predicting when a couple will divorce: Exploratory analyses using 14-year longitudinal data. *Family Process, 41*, 83–96.

Gottman, J. M., Levenson, R. W., & Woodin, E. (2001). Facial expressions during marital conflict. *Journal of Family Communication, 1*, 37–57.

Gray, H., & Goss, C. M. (1966). *Anatomy of the human body* (28th ed.). Philadelphia, PA: Lea & Febiger.

Gross, J. J. (1999). Emotion and emotion regulation. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 525–552). New York, NY: Guilford.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348–362.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1992). Primitive emotional contagion. In M. S. Clark (Ed.), *Emotion and social behavior, Review of personality and social psychology,* Vol 14 (pp. 151–177). Newbury Park, CA: Sage.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotional contagion*. New York, NY: Cambridge University Press.

Hauser, M. (1993). Right hemisphere dominance for the production of facial expression in monkeys. *Science, 261*, 475–477.

Heller, M., & Haynal, V. (1994). Depression and suicide faces. *Cahiers Psychiatriques Genevois, 16*, 107–117.

Hertenstein, M. J., & Campos, J. J. (2004). The retention effects of an adult's emotional displays on infant behavior. *Child Development, 75*, 595–613.

Hess, U., Banse, R., & Kappas, A. (1995). The intensity of facial expression is determined by underlying affective states and social situations. *Journal of Personality and Social Psychology, 69*, 280–288.

Hess, U., & Blairy, S. (2001). Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *International Journal of Psychophysiology, 40*, 129–141.

Hess, U., Kappas, A., McHugo, G. J., & Lanzetta, J. T. (1992). The facilitative effect of facial expression on the self-generation of emotion. *International Journal of Psychophysiology, 12*, 251–265.

Hofstede, G. H. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Hubert, W., & de Jong-Meyer, R. (1990). Psychophysiological response patterns to positive and negative film stimuli. *Biological Psychology, 73–93*.

Hyson, M. C., & Izard, C. E. (1985). Continuities and changes in emotion expressions during brief separation at 13 and 18 months. *Developmental Psychology, 21*, 1165–1170.

Itakura, S. (1993). Emotional behavior during the learning of a contingency task in a chimpanzee. *Perceptual & Motor Skills, 76*, 563–566.

Izard, C. E. (1971). *The face of emotion*. East Norwalk, CT: Appleton-Century-Crofts.

Izard, C. E. (1991). *The psychology of emotions*. New York, NY: Plenum.

Izard, C. E., & Malatesta, C. (1987). Perspectives on emotional development I: Differential emotions theory of early emotional development. In J. S. Osofsky (Ed.), *Handbook of infant development*. New York, NY: Wiley.

Jakobs, E., Manstead, A. S. R., & Fischer, A. H. (2001). Social context effects on facial activity in a negative emotional setting. *Emotion, 1*, 51–69.

Jordan, P. J., & Troth, A. C. (2004). Managing emotions during team problem solving: Emotional intelligence and conflict resolution. *Human Performance, 17*, 195–218.

Kelly, J. R., & Barsade, S. G. (2001). Mood and emotions in small groups and work teams. *Organizational Behavior and Human Decision Processes, 86*, 99–130.

Keltner, D. (1995). The signs of appeasement: Evidence for the distinct displays of embarrassment, amusement, and shame. *Journal of Personality and Social Psychology, 68*, 441–454.

Keltner, D., & Bonanno, G. A. (1997). A study of laughter and dissociation: The distinct correlates of laughter and smiling during bereavement. *Journal of Personality and Social Psychology, 73*, 687–702.

Keltner, D., & Kring, A. M. (1998). Emotion, social function, and psychopathology. *Review of General Psychology, 2*, 320–342.

Keltner, D., Moffitt, T., & Stouthamer-Loeber, M. (1995). Facial expressions of emotion and psychopathology in adolescent boys. *Journal of Abnormal Psychology, 104*, 644–652.

Kendler, K. S., Halberstadt, L. J., Butera, F., Myers, J., Bouchard, T. J., & Ekman, P. (2008). The similarity of facial expressions in response to emotion-inducing films in reared apart twins. *Psychological Medicine, 38*, 1475–1483.

Klinnert, M. D., Campos, J. J., & Sorce, J. F. (1983). Emotions as behavior regulators: Social referencing in infancy. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience* (pp. 57–86). New York, NY: Academic Press.

Krebs, J. R., & Dawkins, R. (1984). Animal signals: Mind reading and manipulation. In J. R. Krebs & R. Dawkins (Eds.), *Behavioural ecology: An evolutionary approach* (pp. 380–402). Sunderland, MA: Sinauer Associates.

Kring, A. M., Smith, D. A., & Neale, J. M. (1994). Individual differences in dispositional expressiveness: Development and validation of the emotional expressivity scale. *Journal of Personality and Social Psychology*, *66*, 934–949.

Lacey, J. I. (1967). Somatic response patterning and stress: Some revisions of activation theory. In M. H. Appley & R. Trumbull (Eds.), *Psychological stress: Issues in research* (pp. 14–42). New York, NY: Appleton-Century-Crofts.

Laird, J. D. (1974). Self-attribution of emotion: The effects of expressive behavior on the quality of emotional experience. *Journal of Personality and Social Psychology, 29*, 475–486.

Laird, J. D. (1984). The real role of facial response in the experience of emotion: A reply to Tourangeau and Ellsworth, and others. *Journal of Personality and Social Psychology, 47*, 909–917.

Lang, P. J. (1988). What are the data of emotion? In V. Hamilton, G. H. Bower, & N. H. Frijda (Eds.), *Cognitive perspectives on emotion and motivation* (pp. 173–191). New York< NY: Kluwer Academic/Plenum Press.

Lanzetta, J. T., Biernat, J. J., & Kleck, R. E. (1982). Self-focused attention, facial behavior, autonomic arousal and the experience of emotion. *Motivation & Emotion, 6*, 49–63.

Larsen, R. J., Kasimatis, M., & Frey, K. (1992). Facilitating the furrowed brow: An unobtrusive test of the facial feedback hypothesis applied to unpleasant affect. *Cognition and Emotion, 6*, 321–338.

Lee, T.-W., Josephs, O., Dolan, R. J., & Critchley, H. D. (2006). Imitating expressions: Emotion-specific neural substrates in facial mimicry. *Social Cognitive and Affective Neuroscience, 9 August 2006*, 1–14.

Lerner, J. S., Gonzalez, R. M., Dahl, R. E., Haririr, A. R., & Taylor, S. E. (2005). Facial expressions of emotion reveal neuroendocrine and cardiovascular stress responses. *Biological Psychiatry, 58*, 743–750.

Levenson, R. W. (1999). The intrapersonal functions of emotion. *Cognition and Emotion, 13*, 481–504.

Levenson, R. W. (2003). Blood, sweat, and fears: The autonomic architecture of emotion. In P. Ekman, J. Campos, R. J. Davidson, & F. B. M. De Waal (Eds.), *Emotions inside out: 130 years after Darwin's "The expression of the emotions in man and animals"* (Vol. 1000, pp. 348–366). New York, NY: New York Academy of Sciences.

Levenson, R. W. (2005). FACS/EMFACS emotion predictions. Berkeley, CA: Computer program available from Robert W. Levenson, University of California, Berkeley.

Levenson, R. W., Carstensen, L. L., Friesen, W. V., & Ekman, P. (1991). Emotion, physiology, and expression in old age. *Psychology & Aging, 6*, 28–35.

Levenson, R. W., Ekman, P., & Friesen, W. V. (1990). Voluntary facial action generates emotion-specific autonomic nervous system activity. *Psychophysiology, 27*, 363–384.

Levenson, R. W., Ekman, P., Heider, K., & Friesen, W. V. (1992). Emotion and autonomic nervous system activity in the Minangkabau of West Sumatra. *Journal of Personality & Social Psychology, 62*, 972–988.

Liebal, K., Pika, S., & Tomasello, M. (2004). Social communication in siamangs (Symphalangus syndactylus): Use of gestures and facial expressions, *Primates, 45*, 41–57.

Lindsey, E. W., MacKinnon-Lewis, C., Campbell, J. D., Frabutt, J. M., & Lamb, M. E. (2002). Marital conflict and boys' peer relationships: The mediating role of mother-son emotional reciprocity. *Journal of Family Psychology, 16*, 466–477.

Marsh, A. A., Ambady, N., & Kleck, R. E. (2005). The effects of fear and anger facial expressions on approach- and avoidance-related behaviors. *Emotion, 5*, 119–124.

Matsumoto, D. (1987). The role of facial response in the experience of emotion: More methodological problems and a meta-analysis. *Journal of Personality & Social Psychology, 52*, 769–774.

Matsumoto, D. (2001). Culture and emotion. In D. Matsumoto (Ed.), *The handbook of culture and psychology* (pp. 171–194). New York, NY: Oxford University Press.

Matsumoto, D. (2007). Playing catch with emotions. *Journal of Intercultural Communication, 10*, 39–49.

Matsumoto, D., & Ekman, P. (1988). Japanese and Caucasian Facial Expressions of Emotion and Neutral Faces (JACFEE and JACNeuF). Retrieved from http://www.humintell.com.

Matsumoto, D., Ekman, P., & Fridlund, A. (1991). Analyzing nonverbal behavior. In P. W. Dowrick (Ed.), *Practical guide to using video in the behavioral sciences* (pp. 153–165). New York, NY: John Wiley & Sons.

Matsumoto, D., Haan, N., Gary, Y., Theodorou, P., & Cooke-Carney, C. (1986). Preschoolers' moral actions and emotions in Prisoner's Dilemma. *Developmental Psychology, 22*, 663–670.

Matsumoto, D., Kasri, F., & Kooken, K. (1999). American-Japanese cultural differences in judgments of expression intensity and subjective experience. *Cognition & Emotion, 13*, 201–218.

Matsumoto, D., Keltner, D., O'Sullivan, M., & Frank, M. G. (2007). What's in a face? Facial expressions as signals of discrete emotions. *Manuscript currently submitted for publication*.

Matsumoto, D., Keltner, D., Shiota, M. N., Frank, M. G., & O'Sullivan, M. (2008). What's in a face? Facial expressions as signals of discrete emotions. In M. Lewis, J. M. Haviland & L. Feldman Barrett (Eds.), *Handbook of emotions* (pp. 211–234). New York, NY: Guilford Press.

Matsumoto, D., Nezlek, J., & Koopmann, B. (2007). Evidence for universality in phenomenological emotion response system coherence. *Emotion, 7*, 57–67.

Matsumoto, D., & Willingham, B. (2006). The thrill of victory and the agony of defeat: Spontaneous expressions of medal winners at the 2004 Athens Olympic Games. *Journal of Personality and Social Psychology, 91*, 568–581.

Matsumoto, D., & Willingham, B. (2009). Spontaneous facial expressions of emotion of congenitally and non-congenitally blind individuals. *Journal of Personality and Social Psychology, 96*, 1–10.

Matsumoto, D., Yoo, S. H., Nakagawa, S., Alexandre, J., Altarriba, J., Anguas-Wong, A. M., . . . Zengaya, A. (2008). Culture, emotion regulation, and adjustment. *Journal of Personality and Social Psychology, 94*, 925–937.

Matsuyama, Y., Hama, H., Kawamura, Y., & Mine, H. (1978). Analysis of emotional words. *Japanese Journal of Psychology, 49*, 229–232.

Mauss, I. B., Levenson, R. W., McCarter, L., Wilhelm, F. L., & Gross, J. J. (2005). The tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion, 5*, 175–190.

Mauss, I. B., Wilhelm, F. L., & Gross, J. J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression, and bodily responding. *Cognition and Emotion, 18*, 631–662.

McCanne, T. R., & Anderson, J. A. (1987). Emotional responding following experimental manipulation of facial electromyographic activity. *Journal of Personality and Social Psychology, 52*, 759–768.

McGhee, P. E. (1977). Children's humour: A review of current research trends. In A. J. Chapman & H. C. Foot (Eds.), *It's a funny thing, humor* (pp. 199–209). Oxford, England: Pergamon.

McIntosh, D. N. (1996). Facial feedback hypotheses: Evidence, implications, and directions. *Motivation & Emotion, 20*, 121–147.

Merten, J., Anstadt, T., Ullrich, B., Krause, R., & Buchhelm, P. (1996). Emotional experience and facial behavior during the psychotherapeutic process and its relation to treatment outcome: A pilot study. *Psychotherapy Research, 6*, 198–212.

Messinger, D. S., Fogel, A., & Dickson, K. L. (2001). All smiles are positive, but some smiles are more positive than others. *Developmental Psychology, 37*, 642–653.

Miller, R. E., Banks, J. H., Jr., & Kuwahara, H. (1966). The communication of affects in monkeys: Cooperative reward conditioning. *Journal of Genetic Psychology, 108*, 121–134.

Miller, R. E., Banks, J. H., Jr., & Ogawa, N. (1963). Role of facial expression in 'cooperative-avoidance conditioning' in monkeys. *Journal of Abnormal and Social Psychology, 67*, 24–30.

Miller, R. E., Caul, W. F., & Mirsky, I. A. (1967). Communication of affects between feral and socially isolated monkeys. *Journal of Personality and Social Psychology, 7*, 231–239.

Miller, R. E., Murphy, J. V., & Mirsky, I. A. (1959). Relevance of facial expression and posture as cues in communication of affect between monkeys. *Archives of General Psychiatry, 1*, 480–488.

Murphy, F. C., Nimmo-Smith, L., & Lawrence, A. D. (2003). Functional neuroanatomy of emotion: A meta-analysis. *Cognitive, Affective, and Behavioral Neuroscience, 3*, 207–233.

Nakamura, K., Kawashima, R., Ito, K., Sugiura, M., Kato, T., Nakamura, A., . . . Kojima, S. (1999). Activation of the right inferior frontal cortex during assessment of facial emotion. *Journal of Neurophysiology, 82*, 1610–1614.

Notarius, C. I., & Johnson, J. S. (1982). Emotional expression in husbands and wives. *Journal of Marriage and the Family, 44*, 483–489.

Ortega, J. E., Iglesias, J., Fernandez, J. M., & Corraliza, J. A. (1983). La expression facial en los ciegos congenitos [Facial expression in the congenitally blind]. *Infancia y Aprendizaje, 21*, 83–96.

Oster, H. (2005). The repertoire of infant facial expressions: An ontogenetic perspective. In J. Nadel & D. Muir (Eds.), *Emotional development* (pp. 261–292). New York, NY: Oxford University Press.

Parr, L. A., Waller, B. M., & Fugate, J. (2005). Emotional communication in primates: Implications for neurobiology. *Current Opinion in Neurobiology, 15*, 716–720.

Parr, L. A., Waller, B. M., Vick, S. J., & Bard, K. A. (2007). Classifying chimpanzee facial expressions using muscle action. *Emotion, 7*, 172–181.

Peleg, G., Katzir, G., Peleg, O., Kamara, M., Brodsky, L., Hel-Or, H., . . . Nevo, E. (2006). Heriditary family signature of facial expression. *Proceedings of the National Academy of Sciences, 103*, 15921–15926.

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the black box: An analysis of work group diversity, conflict, and performance. *Administrative Science Quarterly, 44*, 1–28.

Phan, K. L., Wager, T. D., Taylor, S. F., & Liberzon, I. (2002). Functional neuroanatomy of emotion: A meta-analysis of emotion activation studies in PET and fMRI. *Neuroimage, 16*, (331–348).

Redican, W. K. (1982). An evolutionary perspective on human facial displays. In P. Ekman (Ed.), *Emotion in the human face* (pp. 212–280). New York, NY: Cambridge University Press.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.

Romney, A. K., Moore, C. C., & Rusch, C. D. (1997). Cultural universals: Measuring the semantic structure of emotion terms in English and Japanese. *Proceedings of the National Academy of Sciences, 94*, 5489–5494.

Rosenberg, E. L., & Ekman, P. (1994). Coherence between expressive and experiential systems in emotion. *Cognition & Emotion, 8*, 201–229.

Rosenberg, E. L., Ekman, P., & Blumenthal, J. A. (1998). Facial expression and the affective component of cynical hostility in male coronary heart disease patients. *Health Psychology, 17*, 376–380.

Rosenberg, E. L., Ekman, P., Jiang, W., Babyak, M., Coleman, R. E., Hanson, M., . . . Blumenthal, J. A. (2001). Linkages between facial expressions of anger and transient myocardial ischemia in men with coronary heart disease. *Emotion, 1,* 107–115.

Ruch, W. (1993). Extraversion, alcohol, and enjoyment. *Personality & Individual Differences, 16,* 89–102.

Ruch, W. (1995). Will the real relationship between facial expression and affective experience stand up: The case of exhilaration. *Cognition & Emotion, 9,* 33–58.

Rutledge, L. L., & Hupka, R. B. (1985). The facial feedback hypothesis: Methodological concerns and new supporting evidence. *Motivation & Emotion, 9,* 219–240.

Sayette, M., Wertz, J., Martin, C., Cohn, J., Perrott, M., & Hobel, J. (2003). Effects of smoking opportunity on cue-elicited urge: A facial coding analysis. *Experimental and Clinical Psychopharmacology, 11*, 218–227.

Scheff, T. J. (2006). *Goffman unbound! A new paradigm for social science*. Boulder, CO: Paradigm Publishers.

Schug, J., Matsumoto, D., Horita, Y., Yamagishi, T., & Bonnet, K. (2009). Emotional expressivity as a signal of cooperation. *Manuscript submitted for publication.*

Shaver, P. R., Murdaya, U., & Fraley, R. C. (2001). The structure of the Indonesian emotion lexicon. *Asian Journal of Social Psychology, 4,* 201–224.

Shaver, P. R., Schwartz, J. C., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology, 52,* 1061–1086.

Shaver, P. R., Wu, S., & Schwartz, J. C. (1992). Cross-cultural similarities and differences in emotion and its representation. In M. S. Clark (Ed.), *Emotion. Review of personality and social psychology* (Vol. 13, pp. 175–212). Thousand Oaks, CA: Sage.

Shiller, V. M., Izard, C. E., & Hembree, E. A. (1986). Patterns of emotion expression during separation in the strange-situation procedure. *Developmental Psychology, 22,* 378–382.

Smith, M. C. (1995). Facial expression in mild dementia of the Alzheimer type. *Behavioural Neurology, 8,* 149–156.

Snowdon, C. T. (2003). Expression of emotion in nonhuman animals. In R. J. Davidson, K. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 457–480). New York, NY: Oxford University Press.

Sorce, J. F., Emde, J. J., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology, 21*, 195–200.

Sosik, J. J., & Megerian, L. E. (1999). Understanding leader emotional intelligence and performance: The role of self-other agreement on transformational leadership perceptions. *Group Organization Management, 24*, 367–390.

Soto, J. A., Levenson, R. W., & Ebling, R. (2005). Cultures of moderation and expression: Emotional experience, behavior, and physiology in Chinese Americans and Mexican Americans. *Emotion, 5*, 154–165.

Soussignan, R. (2002). Duchenne smile, emotional experience, and autonomic reactivity: A test of the facial feedback hypothesis. *Emotion, 2*, 52–74.

Steimer-Krause, E., Krause, R., & Wagner, G. (1990). Interaction regulations used by schizophrenic and psychosomatic patients: Studies on facial behavior in dyadic interactions. *Psychiatry, 53*, 209–228.

Thompson, J. (1941). Development of facial expression of emotion in blind and seeing children. *Archives of Psychology, 37*, 1–47.

Tomkins, S. S. (1962). *Affect, imagery, and consciousness* (Vol. 1: The positive affects). New York, NY: Springer.

Tomkins, S. S. (1963). *Affect, imagery, and consciousness* (Vol. 2: The negative affects). New York, NY: Springer.

Triandis, H. C. (1995). *New directions in social psychology: Individualism and collectivism*. Boulder, CO: Westview Press.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*, 112–119.

Tsai, J. L., & Chentsova-Dutton, Y. (2003). Variation among European Americans in emotional facial expressions. *Journal of Cross-Cultural Psychology, 34*, 650–657.

Tsai, J. L., Chentsova-Dutton, Y., Freire-Bebeau, L., & Pryzmus, D. E. (2002). Emotional expression and physiology in European Americans and Hmong Americans. *Emotion, 2*, 380–397.

Tsai, J. L., Levenson, R. W., & Carstensen, L. L. (2000). Autonomic, expressive, and subjective responses to emotional films in older and younger Chinese American and European American adults. *Psychology & Aging, 15*, 684–693.

Tsai, J. L., Pole, N., Levenson, R. W., & Munoz, R. F. (2003). The effects of depression on the emotional responses of Spanish-speaking Latinas. *Cultural Diversity & Ethnic Minority Psychology, 9*, 49–63.

Ueno, A., Ueno, Y., & Tomonaga, M. (2004). Facial responses to four basic tastes in newborn rhesus macaques (Macaca mulatta) and chimpanzees (Pan troglodytes). *Behavioural Brain Research, 154*, 261–271.

van Hooff, J. A. R. A. M. (1972). A comparative approach to the phylogeny of laughing and smiling. In R. A. Hinde (Ed.), *Nonverbal communication* (pp. 209–241). Cambridge, England: Cambridge University Press.

Vaughan, K. B., & Lanzetta, J. T. (1981). The effect of modification of expressive displays on vicarious emotional arousal. *Journal of Experimental Social Psychology, 17*, 16–30.

Vick, S.-J., Waller, B. M., Parr, L. A., Smith Pasqualini, M. C., & Bard, K. A. (2007). A cross species comparison of facial morphology and movement in humans and chimpanzees using the Facial Action Coding System (FACS). *Journal of Nonverbal Behavior, 31*, 1–20.

Waller, B. M., Vick, S.-J., Parr, L. A., Bard, K. A., Pasqualini, M. C. Smith, Gothard, K. M., & Fuglevand, A. J. (2006). Intramuscular electrical stimulation of facial muscles in humans and chimpanzees: Duchenne revisited and extended. *Emotion, 6*, 367–382.

Weinstein, J., Averill, J. R., Opton, E. M., & Lazarus, R. (1968). Defensive style and discrepancy between self-report and physiological indexes of stress. *Journal of Personality and Social Psychology, 10*, 406–413.

Winkielman, P., Berridge, K. C., & Wilbarger, J. L. (2005). Unconscious affective reactions to masked happy versus angry faces influence consumption behavior and judgments of value. *Personality and Social Psychology Bulletin, 31*, 121–135.

Winton, W. M. (1986). The role of facial response in self-reports of emotion: A critique of Laird. *Journal of Personality and Social Psychology, 50*, 808–812.

Zuckerman, M., Klorman, R., Larrance, D. T., & Spiegel, N. H. (1981). Facial, autonomic, and subjective components of emotion: The facial feedback hypothesis versus the externalizer-internalizer distinction. *Journal of Personality and Social Psychology, 41*, 929–944.